CARNEGIE BEAM SECTIONS

CARNEGIE STEEL COMPANY
PITTSBURGH, PA.

F. T. DeYETTE

NOTE

Attention is called to additions and modifications that have been found of advantage to users of Carnegie Beam Sections.

These are as follows:

Additional weights of CB 301, 165 and 151 pounds. Old weights of 135 and 125 pounds have been discontinued and are replaced by new weights of 138 and 126 pounds.

Additional weights of CB 271, 137 and 124 pounds.

Additional heavier weights of CB 146, 14″ column section, advancing by 20 pounds increments from 325 to 425 pounds.

Additional lighter weights of CB 146, 106, 96 and 86 pounds.

A new 12″ x 12″ constant depth column group in weights of 102, 95, 88 and 82 pounds, to be called CB 124 C. CB 124 and CB 124 A have been discontinued.

A new 12″ x 12″ constant depth column group in weights of 76, 70 and 65 pounds, to be called CB 124 B.

CB 123 A is changed to a variable depth section in weights of 66, 60 and 55 pounds and will be called CB 123 B.

A new 10″ x 10″ constant depth column group in weights of 64, 59, 54 and 49 pounds, to be called CB 103 A. CB 103 has been discontinued.

New minimum weights of B 40, 20.5 pounds and B 39, 17.5 pounds. Minimum weights as formerly published B 40, 21 pounds and B 39, 18 pounds have been discontinued.

For additional information and data reference should be made to supplementary issue entitled:

CARNEGIE BEAM SECTIONS

Additions to New Series

SECOND EDITION—OCTOBER 1, 1928

CARNEGIE BEAM SECTIONS

PROFILES, PROPERTIES

AND

SAFE LOADS

FOR

NEW SERIES

OF

STRUCTURAL STEEL BEAMS

AND

COLUMN SECTIONS

MANUFACTURED BY

CARNEGIE STEEL COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

PITTSBURGH, PA.

FIRST EDITION

A. I. A. FILE NO. 13

G11618VM1028

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CARNEGIE STEEL COMPANY
Pittsburgh, Pa.

First Edition, January 1, 1927. Printed in U. S. A.

SINCE the adoption of the present American Standard Beam Sections, in 1896, developments of such magnitude have taken place in the structural steel industry, both at home and abroad, as to demand an improved series of rolled sections suitable for both beam and column purposes.

The series now placed on the market under the name **CARNEGIE BEAM SECTIONS,** provides for this demand by means of a series of shapes combining sound engineering principles with practical improvements. All its sections are produced on a structural mill of the most advanced type.

The series provides a range of rolled steel beam and column sections progressing by regular steps, with contours that will permit sections to be used interchangeably for whichever purpose they are adapted, and in sizes and weights sufficiently varied to meet all ordinary requirements. Their efficiency is high and their component parts are proportioned to permit of ready fabrication.

ADVANTAGES

The advantages characterizing the new series of Carnegie Beam Sections will be explained under the following captions:—

CONTOUR DESIGN
WEB AND FLANGE RATIO
RANGE OF SIZES
PROGRESSIVE BEAM DESIGN
IMPROVED COLUMN DESIGN

CONTOUR DESIGN

A new form of contour has been adopted whose principal characteristic is the elimination of internal flange slope, the flanges being of uniform thickness throughout their width. This feature increases the strength of the section, permits simpler connections and facilitates fabrication.

Carnegie Beam Sections permit the use of maximum unit stresses in shear and compression for resistance to web buckling and flange crippling, respectively, in conformity with usual building specifications. All fillets, which are parabolic in form, combine maximum spread with minimum area.

WEB AND FLANGE RATIO

In the production of most of the Carnegie Beam Sections a method is used whereby an adequate variety of weights in each group, having substantially equal efficiency per pound, is attained by spreading both horizontal and vertical rolls a proportionate amount. This practice causes the depth of sections to vary somewhat from the nominal, but this variation is kept within limits that will not affect the standardization of details.

A second characteristic, found in the heavier groups of column sections, is an increase in width as compared with depth, combining maximum economy in design of framing and in floor space.

RANGE OF SIZES

Carnegie Beam Sections provide a range of beam and column shapes, from 8 to 30 inches deep and from 5 to 16 inches wide, in weights up to 305 pounds per linear foot, with section moduli about the major axis up to 738 $in.^3$, and with radii of gyration about the minor axis up to 4.14 in.

In general, no sharp line has been drawn between beams, girder beams and columns. The consequent economy in number of sections will insure better deliveries, reduce the number of sizes carried in stock, and allow a greater standardization in shop methods and tools.

Profiles, dimensions and weights are given on pages 8 to 30. Other data pertaining to dimensions and properties are tabulated on pages 32 to 41.

The range of depths in which occurs the greatest normal demand is covered by the adoption of sections 14 and 16 inches deep, affording the designer a better and more economical selection of sections to be used as beams.

PROGRESSIVE BEAM DESIGN

The introduction of the 14 and 16 inch Carnegie Beam Sections gives a progressive series in which each depth is approximately 15 per cent. greater than the preceding depth, as shown graphically on range charts on pages 32 and 33. In addition, successive weights in each group are so arranged that their strengths progress by steps having close and approximately regular ratios of increase.

Intermediate groups of heavier sections, of the same depth but with wider flanges and greater strength, are provided for use as beams in structures where it is important to limit the depth of section. These sections are also suitable for columns.

The selectivity of the series for use as beams is indicated graphically in the tables and charts on pages 32 to 35.

Minimum weights of 10-, 12-, 14- and 16-inch sections are offered with a uniform width of 6 inches, which permits a corresponding uniformity in fireproofing and finish.

Very complete groups of sections 24, 27 and 30 inches deep, are provided with flanges 14 inches wide. These will be found convenient for use in structures that cannot be braced laterally and may also be used to advantage where limited clearance is an important factor in design.

Efficient sections, notably 12 inches and deeper, are provided with webs $\frac{3}{8}$ inch in thickness, in order to comply with specifications requiring a minimum thickness of metal.

IMPROVED COLUMN DESIGN

Carnegie Beam Sections include two groups: a **Variable-Depth Type** and a **Constant-Depth Type.** The sections of the latter group are intended primarily for columns, though sections of either type may also be used as beams or girders. In the **Variable-Depth Type** both depth and width increase proportionately as weights increase from the minimum. In the **Constant-Depth Type** the depth does not change, the increase in weights being obtained by thickening the web and widening the flanges. With the heavier groups of both types, high properties about the minor axis are secured by the proportions adopted.

The **Variable-Depth Type** contains notably sections of the following depth, flange width and weights:—

CB 83	**8″ x 8″**	**31 to 90 lbs.**
CB 145	**14″ x 12″**	**85 to 105 lbs.**
CB 146	**14″ x 15″**	**115 to 305 lbs.**

These sections will be used principally as columns.

In addition, sections 8, 9, 10, 12 and 14 inches deep, are provided having intermediate flange widths which may be used either as beams in shallow floors or as light columns.

The **Constant-Depth Type** is offered in two depths only, 10 and 12 inches, with the following flange widths and weights:—

CB 102	**10″ x 8″**	**31 to 42 lbs.**	**CB 124**	**12″ x 10″**	**75 to 100 lbs.**
CB 103	**10″ x 9″**	**49 to 63 lbs.**	**CB 125**	**12″ x 12″**	**110 to 140 lbs.**
CB 104	**10″ x 10″**	**70 to 92 lbs.**	**CB 126**	**12″ x 14″**	**150 to 180 lbs.**
CB 105	**10″ x 12″**	**100 to 140 lbs.**	**CB 127**	**12″ x 14″**	**190 to 230 lbs.**

The 10-inch series will take care of an ordinary 12-story building, while the 12-inch series, in conjunction with the 10-inch series, will take care of an ordinary 18-story building. If desired, the scope of any group can be extended by reinforcement with flange plates.

The Constant-Depth Type presents an innovation in rolled steel column sections in that the over-all depth for all sizes of a nominal depth does not vary. The advantages of this feature are reflected in the symmetry of beam and spandrel framework connecting to the columns at a number of successive floors in a steel building, thus effecting a substantial saving in the drafting room, fabricating shop and in the field. The avoidance of fillers under splices on the columns themselves is also advantageous. To the architect and the general contractor constant depth is valuable in that it permits a greater uniformity in fireproofing and finish.

MISCELLANEOUS DATA

All weights per linear foot of Carnegie Beam Sections are expressed in whole pounds. Fillets are included in weights, areas and other properties.

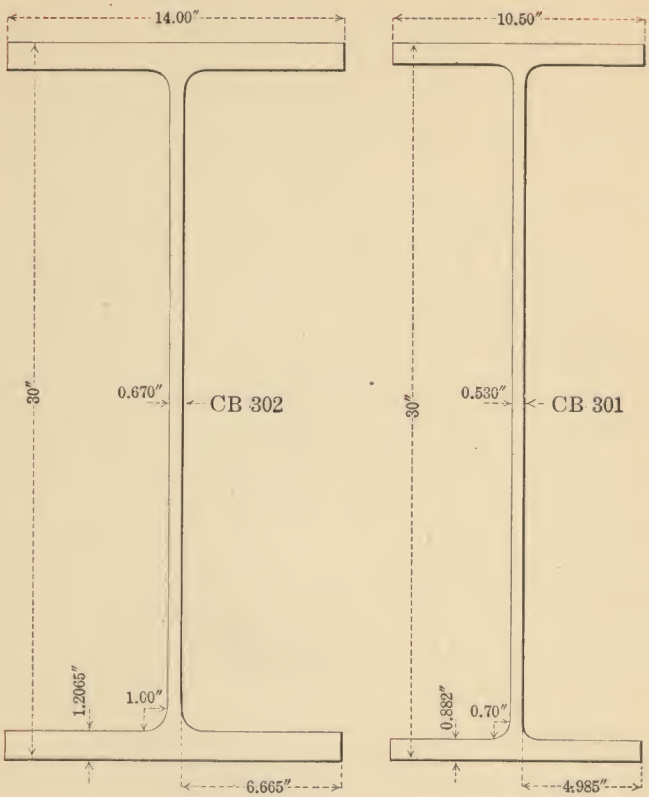
The dimensions to which the rolls for Carnegie Beam Sections are turned extend to three decimal places of an inch, as shown on diagrams on pages 8 to 29, but it will be more convenient for the designer to use the fractions to which they have been rounded in the tables of dimensions of sections on pages 33 to 41.

Carnegie Beam Sections will be furnished to the specifications of the Association of American Steel Manufacturers, American Society of Testing Materials or to such other acceptable standard specifications as may be required.

CARNEGIE
BEAM SECTIONS

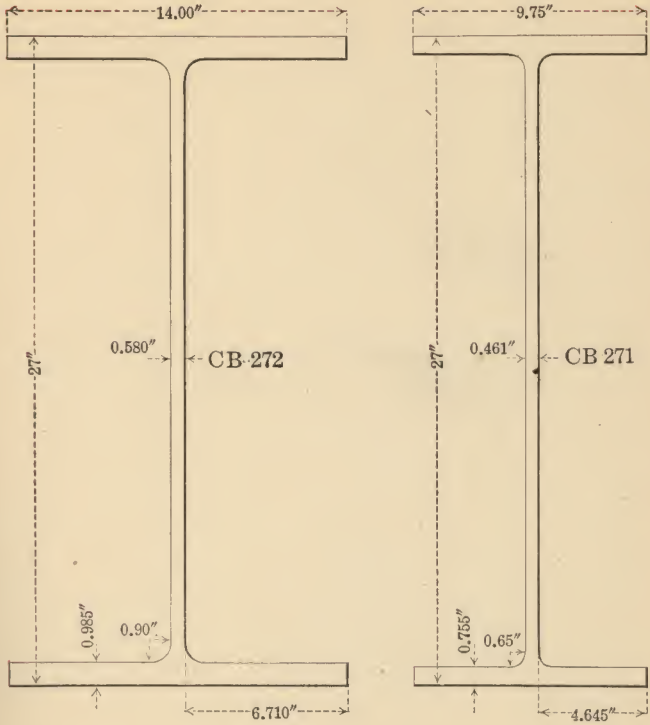
PROFILES AND DIMENSIONS

CARNEGIE BEAM SECTIONS



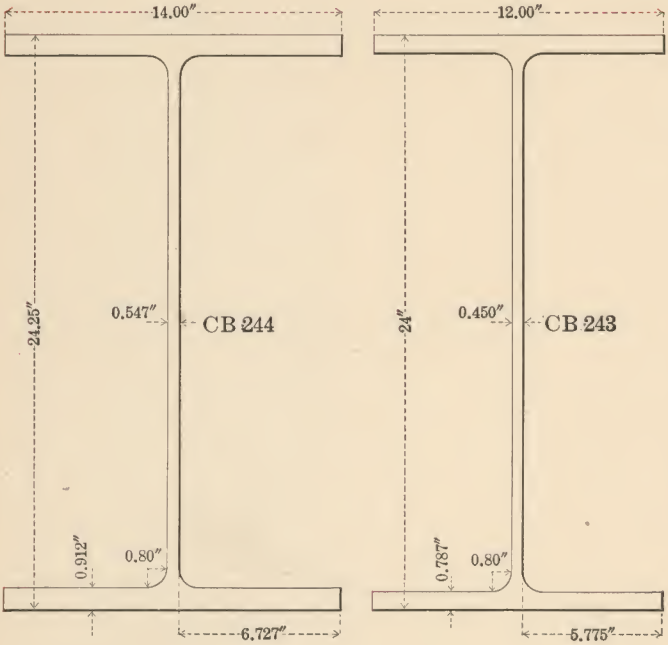
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 302	30.781	30 25/32	240	14.218	14 7/32	1.597	1 19/32	0.888	57/64
	30.522	30 33/64	220	14.146	14 9/64	1.4675	1 15/32	0.816	13/16
	30.263	30 17/64	200	14.073	14 5/64	1.338	1 11/32	0.743	3/4
	30.000	30	180	14.000	14	1.2065	1 13/64	0.670	43/64
CB 301	30.298	30 19/64	135	10.591	10 19/32	1.031	1 1/32	0.621	5/8
	30.148	30 9/64	125	10.546	10 35/64	0.956	61/64	0.576	37/64
	30.000	30	115	10.500	10 1/2	0.882	7/8	0.530	17/32

CARNEGIE BEAM SECTIONS—Continued



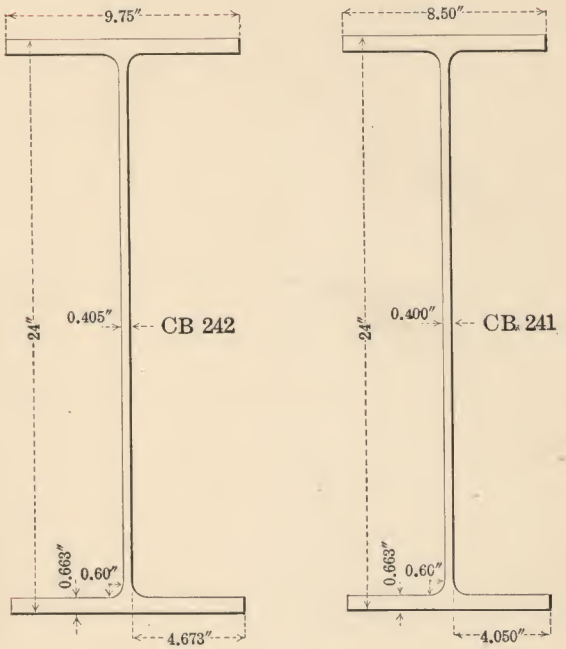
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 272	27.598	27 19/32	190	14.176	14 11/64	1.284	1 9/32	0.756	3/4
	27.400	27 13/32	175	14.118	14 1/8	1.185	1 3/16	0.698	45/64
	27.200	27 3/64	160	14.059	14 1/16	1.085	1 5/64	0.639	41/64
	27.000	27	145	14.000	14	0.985	63/64	0.580	37/64
CB 271	27.340	27 11/32	112	9.855	9 55/64	0.925	59/64	0.566	9/16
	27.166	27 11/64	101	9.799	9 51/64	0.838	27/32	0.510	33/64
	27.000	27	91	9.750	9 3/4	0.755	3/4	0.461	15/32

CARNEGIE BEAM SECTIONS—Continued



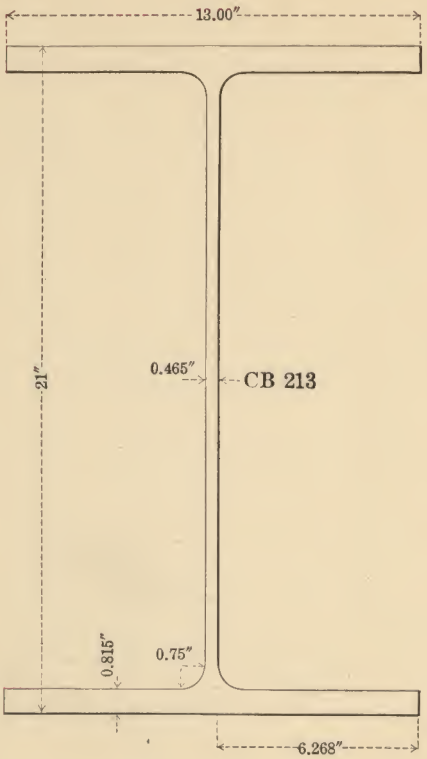
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 244	24.664	24 21/32	160	14.123	14 1/8	1.119	1 1/8	0.670	43/64
	24.526	24 17/32	150	14.082	14 5/64	1.050	1 3/64	0.629	5/8
	24.388	24 25/64	140	14.041	14 3/64	0.981	63/64	0.588	19/32
	24.250	24 1/4	130	14.000	14	0.912	29/32	0.547	35/64
CB 243	24.310	24 5/16	120	12.089	12 3/32	0.942	15/16	0.539	17/32
	24.156	24 5/32	110	12.044	12 3/64	0.865	55/64	0.494	1/2
	24.000	24	100	12.000	12	0.787	25/32	0.450	29/64

CARNEGIE BEAM SECTIONS—Continued



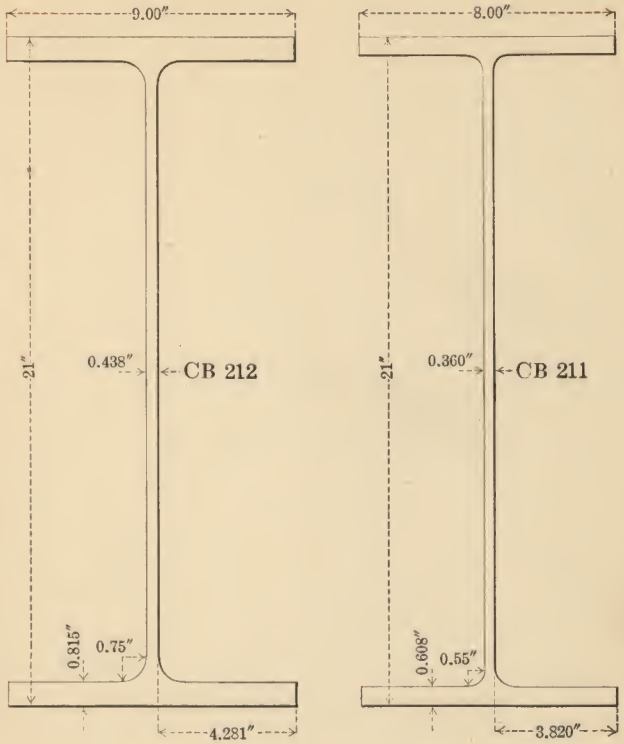
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	24.308	24 5/16	94	9.844	9 21/32	0.817	1 13/16	0.499	1/2
CB 242	24.154	24 5/32	85	9.797	9 51/64	0.740	47/64	0.452	29/64
	24.000	24	76	9.750	9 3/4	0.663	21/32	0.405	13/32
CB 241	24.000	24	70	8.500	8 1/2	0.663	21/32	0.400	13/32

CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 213	21.248	21¼	120	13.070	13 1/16	0.939	15/16	0.535	17/32
	21.126	21⅛	112	13.034	13 1/32	0.878	⅞	0.499	½
	21.000	21	104	13.000	13	0.815	13/16	0.465	15/32

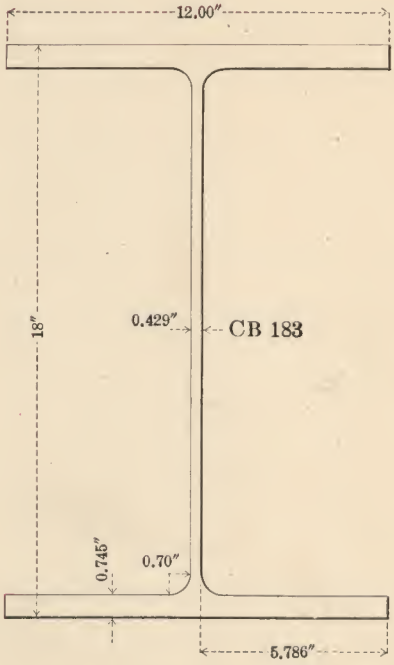
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	21.240	21 15/64	92	9.064	9 1/16	0.935	15/16	0.502	1/2
CB 212	21.120	21 1/8	86	9.032	9 1/32	0.875	7/8	0.470	15/32
	21.000	21	80	9.000	9	0.815	13/16	0.438	7/16
	21.248	21 1/4	70	8.073	8 5/64	0.732	47/64	0.433	7/16
CB 211	21.126	21 1/8	64	8.036	8 1/32	0.671	43/64	0.396	25/64
	21.000	21	58	8.000	8	0.608	39/64	0.360	23/64
	*21.034	21 1/32	60	8.015	8 1/64	0.625	5/8	0.375	3/8

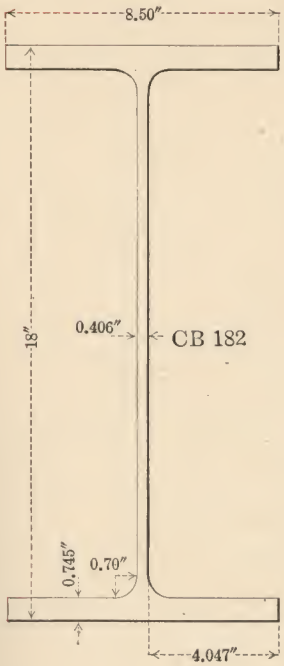
*Special Section Web Thickness 3/8″.

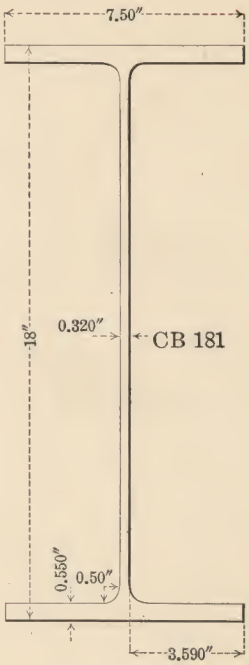
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 183	18.238	18 15/64	100	12.069	12 1/16	0.864	55/64	0.498	1/2
	18.120	18 1/8	93	12.034	12 1/32	0.805	13/16	0.463	15/32
	18.000	18	86	12.000	12	0.745	3/4	0.429	27/64

CARNEGIE BEAM SECTIONS—Continued

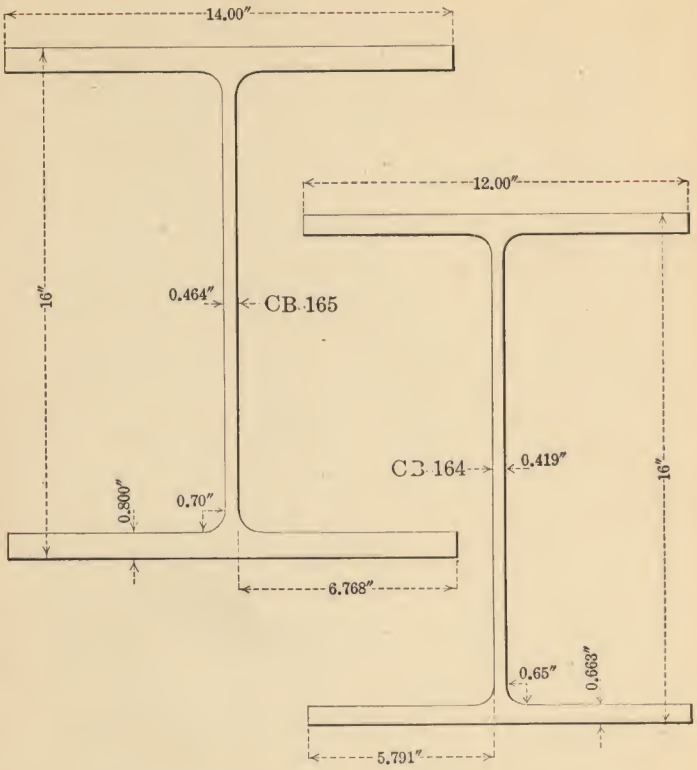




Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	18.242	18 15/64	78	8.565	8 9/16	0.866	55/64	0.471	15/32
CB 182	18.110	18 7/64	72	8.530	8 17/32	0.800	51/64	0.436	7/16
	18.000	18	67	8.500	8 1/2	0.745	3/4	0.406	13/32
	18.252	18 1/4	58	7.573	7 37/64	0.676	43/64	0.393	25/64
CB 181	18.114	18 7/64	52	7.534	7 17/32	0.607	39/64	0.354	23/64
	18.000	18	47	7.500	7 1/2	0.550	35/64	0.320	5/16
	*18.024	18 1/32	51	7.555	7 9/16	0.562	9/16	0.375	3/8

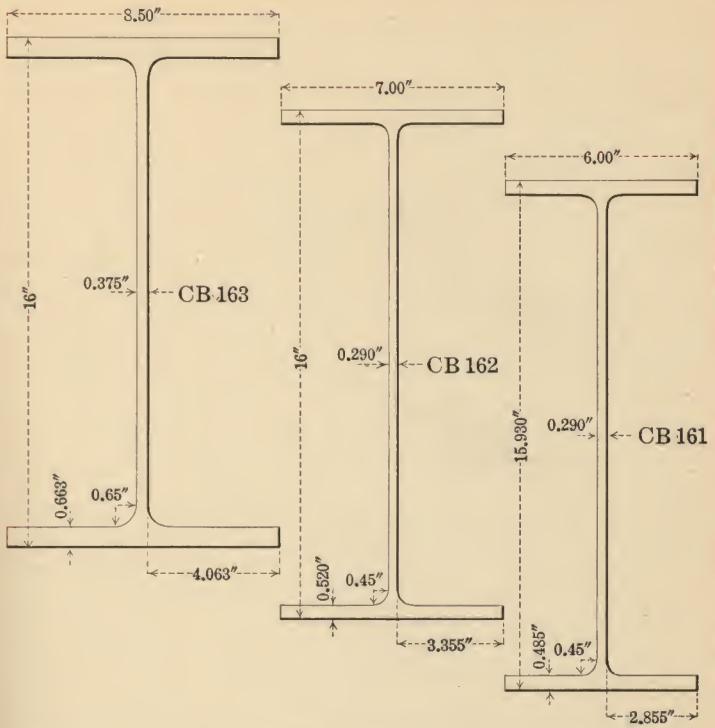
*Special Section Web Thickness 3/8″.

CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	16.236	16 15/64	115	14.068	14 1/16	0.918	59/64	0.532	17/32
CB 165	16.110	16 7/64	107	14.032	14 1/32	0.855	55/64	0.496	1/2
	16.000	16	100	14.000	14	0.800	51/64	0.464	15/32
	16.240	16 15/64	90	12.076	12 5/64	0.783	25/32	0.495	1/2
CB 164	16.120	16 1/8	83	12.039	12 1/32	0.723	23/32	0.458	29/64
	16.000	16	76	12.000	12	0.663	21/32	0.419	27/64

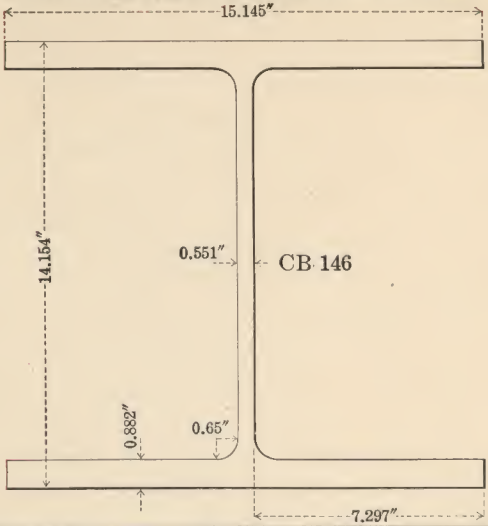
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 163	16.226	16 7/32	68	8.563	8 9/16	0.776	25/32	0.438	7/16
	16.114	16 7/64	63	8.531	8 17/32	0.720	23/32	0.406	13/32
	16.000	16	58	8.500	8 1/2	0.663	21/32	0.375	3/8
CB 162	16.254	16 1/4	50	7.072	7 5/64	0.647	41/64	0.362	23/64
	16.128	16 1/8	45	7.036	7 1/32	0.584	37/64	0.326	21/64
	16.000	16	40	7.000	7	0.520	33/64	0.290	19/64
	*15.934	15 15/16	43	7.085	7 5/64	0.487	31/64	0.375	3/8
CB 161	16.012	16 1/64	38	6.024	6 1/32	0.526	17/32	0.314	5/16
	15.930	15 15/16	35	6.000	6	0.485	31/64	0.290	19/64

*Special Section Web Thickness 3/8″.

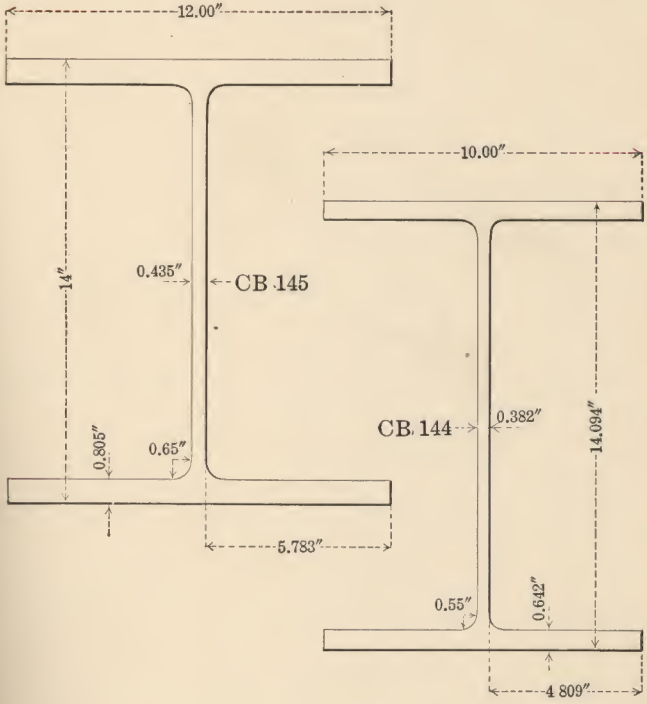
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 146	16.890	16 57/64	305	16.000	16	2.250	2 1/4	1.406	1 13/32
	16.752	16 3/4	295	15.956	15 61/64	2.181	2 3/16	1.362	1 23/64
	16.614	16 39/64	285	15.912	15 29/32	2.112	2 7/64	1.318	1 5/16
	16.472	16 15/32	275	15.870	15 7/8	2.041	2 3/64	1.276	1 9/32
	16.332	16 1/64	265	15.826	15 53/64	1.971	1 31/32	1.232	1 15/64
	16.192	16 3/16	255	15.781	15 25/32	1.901	1 29/32	1.187	1 3/16
	16.050	16 3/64	245	15.738	15 47/64	1.830	1 53/64	1.144	1 9/64
	15.908	15 29/32	235	15.693	15 11/16	1.759	1 49/64	1.099	1 3/32
	15.764	15 49/64	225	15.650	15 21/32	1.687	1 11/16	1.056	1 1/16
	15.622	15 5/8	215	15.604	15 39/64	1.616	1 39/64	1.010	1 1/64
	15.478	15 31/64	205	15.559	15 9/16	1.544	1 35/64	0.965	31/32
	15.334	15 21/64	195	15.513	15 33/64	1.472	1 15/32	0.919	59/64
	15.188	15 3/16	185	15.469	15 15/32	1.399	1 13/32	0.875	7/8
	15.042	15 3/64	175	15.424	15 27/64	1.326	1 21/64	0.830	53/64
	14.896	14 57/64	165	15.377	15 3/8	1.253	1 1/4	0.783	25/32
	14.750	14 3/4	155	15.330	15 21/64	1.180	1 3/16	0.736	47/64
	14.602	14 39/64	145	15.284	15 9/32	1.106	1 7/64	0.690	1 11/16
	14.452	14 29/64	135	15.239	15 15/64	1.031	1 1/32	0.645	41/64
	14.304	14 19/64	125	15.191	15 3/16	0.957	61/64	0.597	19/32
	14.154	14 5/32	115	15.145	15 9/64	0.882	7/8	0.551	35/64
	*14.162	14 5/32	131	15.468	15 15/32	0.886	57/64	0.874	7/8

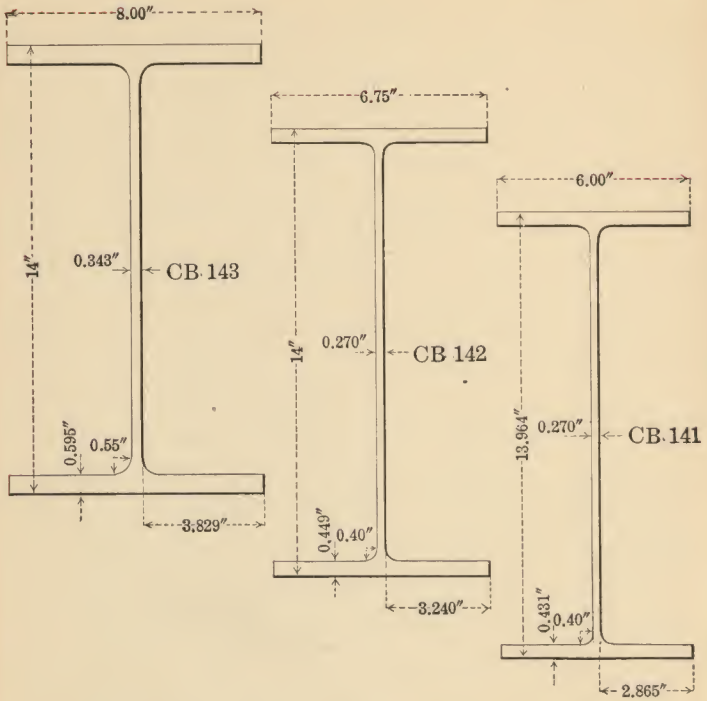
*Special Section for Column Core.

CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	14.370	14 3/8	105	12.101	12 3/32	0.990	6 3/64	0.536	17/32
CB 145	14.186	14 3/16	95	12.050	12 3/64	0.898	5 7/64	0.485	31/64
	14.000	14	85	12.000	12	0.805	13/16	0.435	7/16
	14.382	14 3/8	75	10.086	10 3/32	0.786	25/32	0.468	15/32
CB 144	14.238	14 15/64	68	10.043	10 3/64	0.714	23/32	0.425	27/64
	14.094	14 3/32	61	10.000	10	0.642	41/64	0.382	3/8

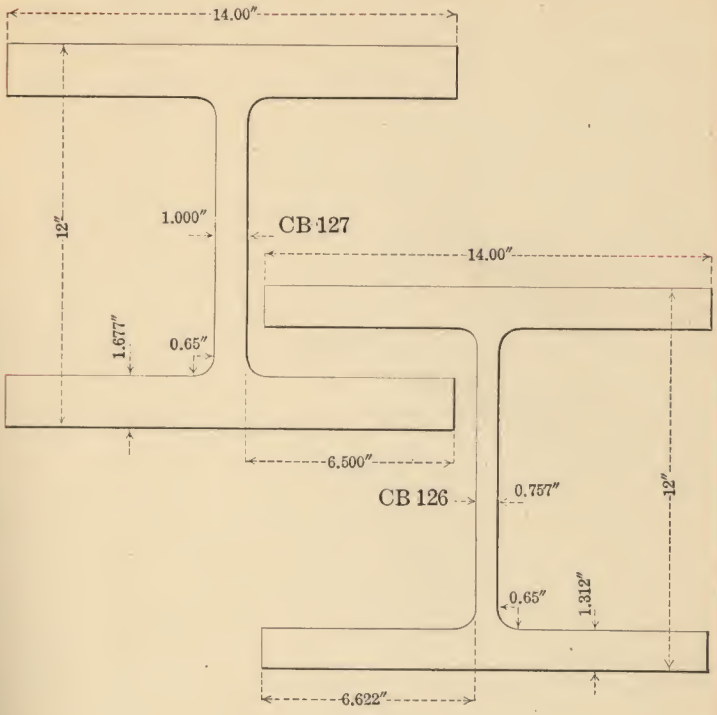
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	14.242	14 15/64	58	8.070	8 1/16	0.716	23/32	0.413	13/32
CB 143	14.122	14 1/8	53	8.035	8 1/32	0.656	21/32	0.378	3/8
	14.000	14	48	8.000	8	0.595	19/32	0.343	11/32
	14.240	14 15/64	42	6.822	6 53/64	0.569	9/16	0.342	11/32
	14.160	14 5/32	39	6.798	6 51/64	0.529	17/32	0.318	5/16
CB 142	14.080	14 5/64	36	6.774	6 25/32	0.489	31/64	0.294	19/64
	14.000	14	33	6.750	6 3/4	0.449	29/64	0.270	17/64
	*14.000	14	38	6.855	6 55/64	0.449	29/64	0.375	3/8
CB 141	13.964	13 31/32	30	6.000	6	0.431	7/16	0.270	17/64

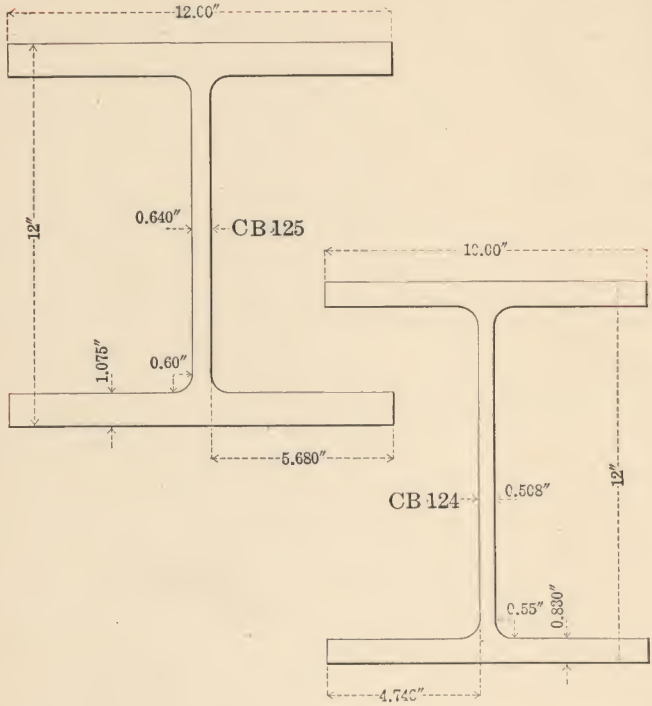
*Special Section Web Thickness 3/8″.

CARNEGIE BEAM SECTIONS—Continued



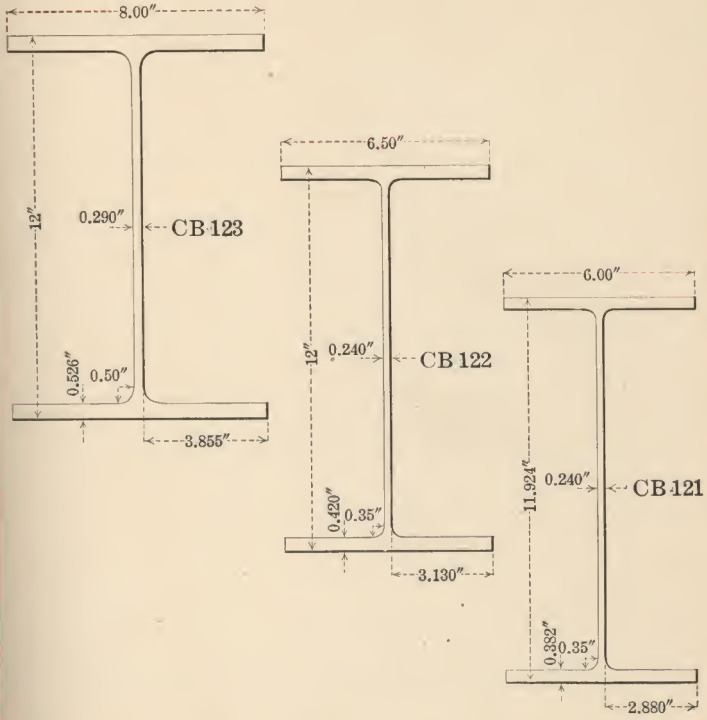
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 127	12 (CONSTANT)	12	230	14.980	$14\frac{63}{64}$	1.677	$1\frac{43}{64}$	1.980	$1\frac{63}{64}$
			220	14.735	$14\frac{47}{64}$			1.735	$1\frac{47}{64}$
			210	14.490	$14\frac{31}{64}$			1.490	$1\frac{31}{64}$
			200	14.245	$14\frac{1}{4}$			1.245	$1\frac{1}{4}$
			190	14.000	14			1.000	1
CB 126	12 (DEPTH)	12	180	14.735	$14\frac{47}{64}$	1.312	$1\frac{5}{16}$	1.492	$1\frac{31}{64}$
			170	14.490	$14\frac{31}{64}$			1.247	$1\frac{1}{4}$
			160	14.245	$14\frac{1}{4}$			1.002	1
			150	14.000	14			0.757	$\frac{3}{4}$

CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 125	CONSTANT DEPTH 12	12	140	12.736	$12\frac{47}{64}$	1.075	$1\frac{5}{64}$	1.376	$1\frac{3}{8}$
			130	12.491	$12\frac{31}{64}$			1.131	$1\frac{1}{8}$
			120	12.245	$12\frac{1}{4}$			0.885	$\frac{57}{64}$
			110	12.000	12			0.640	$\frac{41}{64}$
CB 124			100	10.613	$10\frac{39}{64}$	0.830	$\frac{53}{64}$	1.121	$1\frac{1}{8}$
			91	10.392	$10\frac{25}{64}$			0.900	$\frac{29}{32}$
			83	10.196	$10\frac{13}{64}$			0.704	$\frac{45}{64}$
			75	10.000	10			0.508	$\frac{33}{64}$

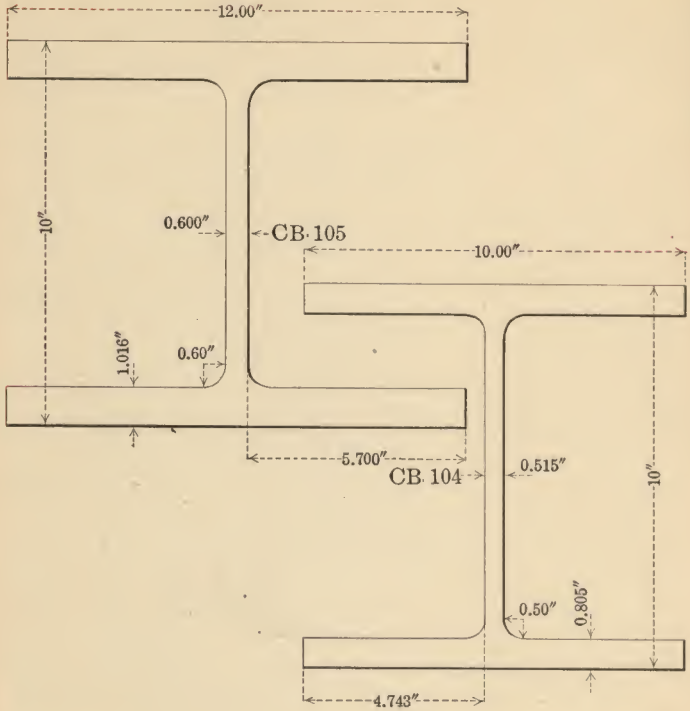
CARNEGIE BEAM SECTIONS—Continued



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 123	12.258	12 1/4	50	8.071	8 5/64	0.655	2 1/32	0.361	23/64
	12.130	12 1/8	45	8.036	8 1/32	0.591	19/32	0.326	21/64
	12.000	12	40	8.000	8	0.526	17/32	0.290	19/64
CB 122	12.236	12 15/64	36	6.568	6 9/16	0.538	17/32	0.308	5/16
	12.118	12 1/8	32	6.534	6 17/32	0.479	31/64	0.274	9/32
	12.000	12	28	6.500	6 1/2	0.420	27/64	0.240	15/64
	*12.022	12 1/64	34	6.635	6 41/64	0.431	7/16	0.375	3/8
CB 121	11.924	11 59/64	25	6.000	6	0.382	3/8	0.240	15/64

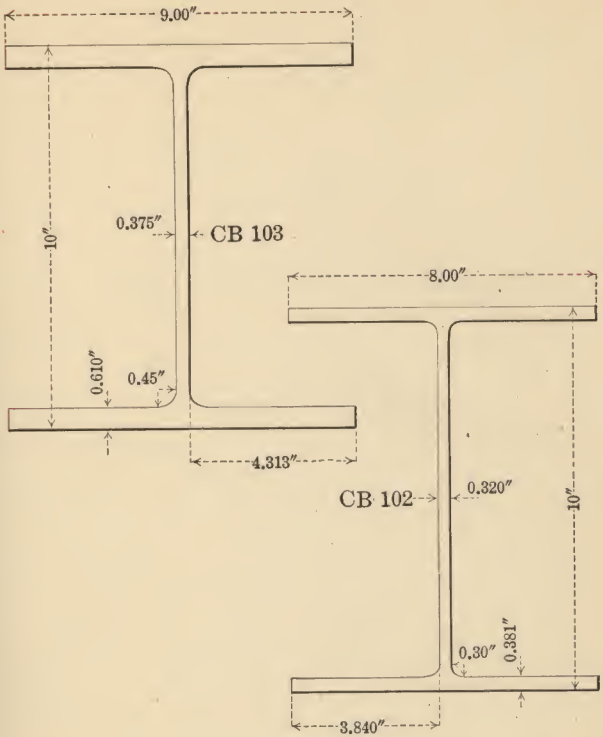
*Special Section Web Thickness 3/8″.

CARNEGIE BEAM SECTIONS—Continued



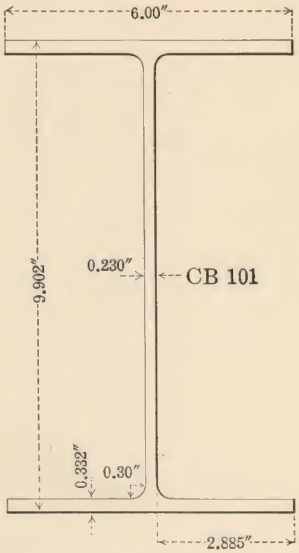
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 105 (CONSTANT DEPTH)	10	10	140	13.177	13 1/16	1.016	1 1/64	1.777	1 25/32
			132	12.941	12 15/16			1.541	1 35/64
			124	12.706	12 45/64			1.306	1 5/16
			116	12.471	12 15/32			1.071	1 9/64
			108	12.236	12 15/64			0.836	27/32
			100	12.000	12			0.600	19/32
CB 104 (CONSTANT DEPTH)	10	10	92	10.647	10 41/64	0.805	13/16	1.162	1 5/32
			84	10.411	10 13/32			0.926	59/64
			77	10.206	10 13/64			0.721	23/32
			70	10.000	10			0.515	33/64

CARNEGIE BEAM SECTIONS—Continued



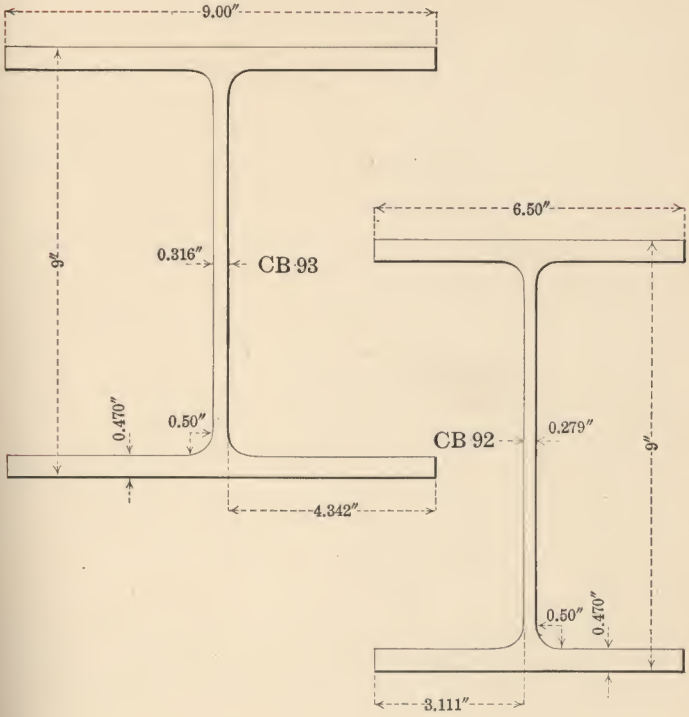
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 103	CONSTANT 10	10	63	9.412	$9\frac{13}{32}$	0.610	$\frac{39}{64}$	0.787	$\frac{25}{32}$
			56	9.206	$9\frac{13}{64}$			0.581	$\frac{37}{64}$
			49	9.000	9			0.375	$\frac{3}{8}$
CB 102	DEPTH 10	10	42	8.324	$8\frac{21}{64}$	0.381	$\frac{3}{8}$	0.644	$\frac{41}{64}$
			36	8.147	$8\frac{9}{64}$			0.467	$\frac{15}{32}$
			31	8.000	8			0.320	$\frac{5}{16}$

CARNEGIE BEAM SECTIONS—Continued



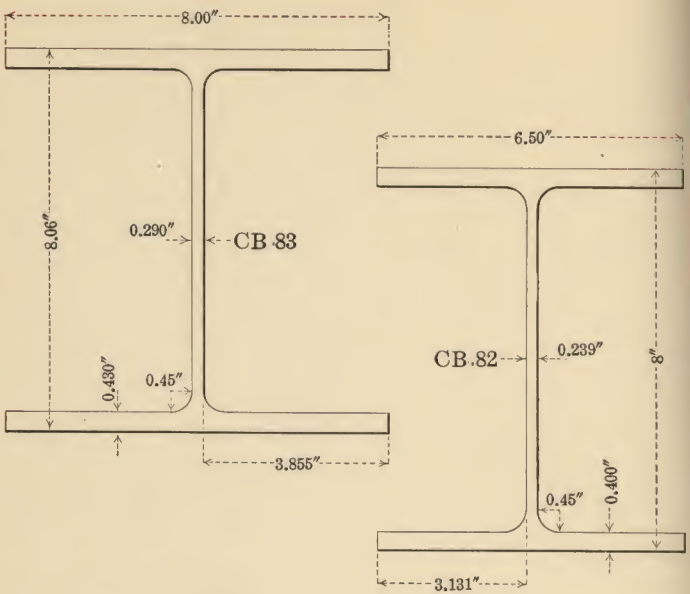
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
CB 101	10.228	10 15/64	30	6.068	6 1/16	0.495	1/2	0.298	19/64
	10.098	10 3/32	26	6.029	6 1/32	0.430	7/16	0.259	17/64
	10.000	10	23	6.000	6	0.381	3/8	0.230	15/64
	9.902	9 29/32	21	6.000	6	0.332	21/64	0.230	15/64

CARNEGIE BEAM SECTIONS—Continued



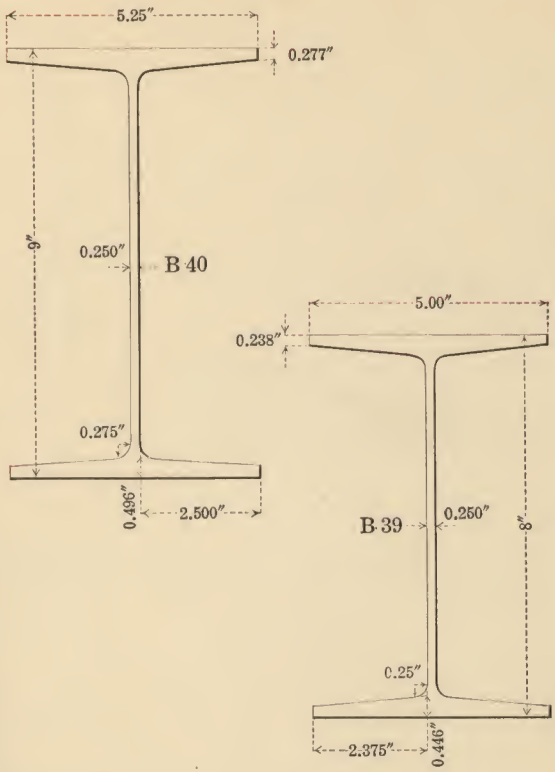
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	9.242	9 15/64	48	9.082	9 5/64	0.591	19/32	0.398	25/64
CB 93	9.122	9 1/8	43	9.041	9 3/64	0.531	17/32	0.357	23/64
	9.000	9	38	9.000	9	0.470	15/32	0.316	5/16
	9.192	9 3/16	35	6.556	6 9/16	0.566	9/16	0.335	21/64
CB 92	9.096	9 3/32	32	6.528	6 17/32	0.518	33/64	0.307	5/16
	9.000	9	29	6.500	6 1/2	0.470	15/32	0.279	9/32

CARNEGIE BEAM SECTIONS—Concluded



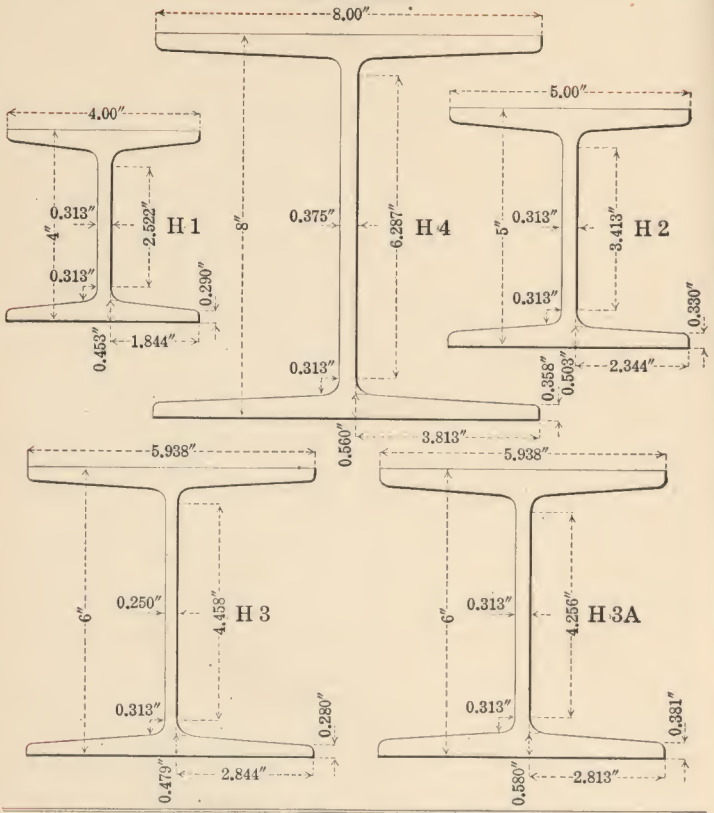
Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
	9.606	9 39/64	90	8.520	8 33/64	1.203	1 13/64	0.810	13/16
	9.456	9 29/64	84	8.469	8 15/32	1.128	1 1/8	0.759	49/64
	9.302	9 19/64	78	8.418	8 27/64	1.051	1 3/64	0.708	45/64
	9.150	9 5/32	72	8.366	8 23/64	0.975	31/32	0.656	21/32
	8.994	9	66	8.314	8 5/16	0.897	57/64	0.604	39/64
CB 83	8.838	8 27/32	60	8.261	8 17/64	0.819	13/16	0.551	35/64
	8.680	8 11/16	54	8.208	8 13/64	0.740	47/64	0.498	1/2
	8.520	8 33/64	48	8.155	8 5/32	0.660	21/32	0.445	7/16
	8.360	8 23/64	42	8.100	8 3/32	0.580	37/64	0.390	25/64
	8.198	8 13/64	36	8.046	8 1/64	0.499	1/2	0.336	11/32
	8.060	8 1/16	31	8.000	8	0.430	7/16	0.290	19/64
	8.196	8 13/64	30	6.559	6 9/16	0.498	1/2	0.298	19/64
CB 82	8.098	8 3/32	27	6.529	6 17/32	0.449	29/64	0.268	17/64
	8.000	8	24	6.500	6 1/2	0.400	13/32	0.239	15/64

STANDARD MILL SECTIONS



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Mean Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
B 40	9	9	25	5.380	5⅜	0.3865	25/64	0.380	⅜
			21	5.250	5¼			0.250	¼
B 39	8	8	21	5.110	5 7/64	0.342	11/32	0.360	23/64
			18	5.000	5			0.250	¼

H-BEAMS



Section Index	Depth of Section, Inches		Weight per Foot, Pounds	Flange Width, Inches		Mean Flange Thickness, Inches		Web Thickness, Inches	
	Decimal	Fraction		Decimal	Fraction	Decimal	Fraction	Decimal	Fraction
H 4	8	8	37.7	8.125	8⅛	0.459	29/64	0.500	½
			34.3	8.000	8			0.375	3/8
			32.6	7.938	7 15/16			0.313	5/16
H 3A	6	6	27.5	6.063	6 1/16	0.481	31/64	0.438	7/16
			25.0	5.938	5 15/16			0.313	5/16
H 3	6	6	22.5	6.063	6 1/16	0.379	3/8	0.375	3/8
			20.0	5.938	5 15/16			0.250	¼
H 2	5	5	18.9	5.000	5	0.417	27/64	0.313	5/16
H 1	4	4	13.8	4.000	4	0.372	3/8	0.313	5/16

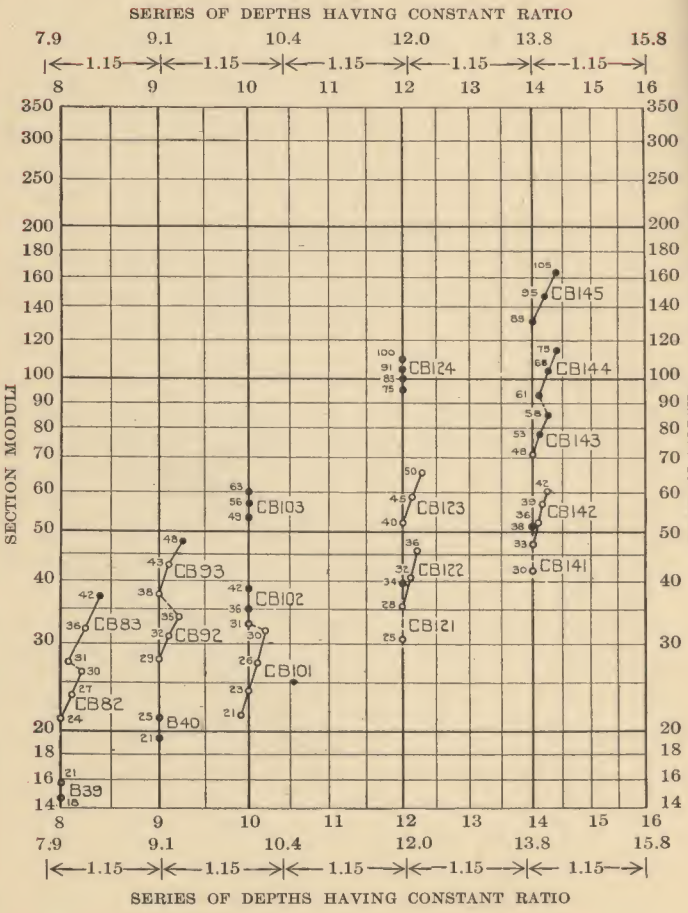
Full information as to uses of H-Beams is given in pamphlet entitled "Steel Mine Timbers."

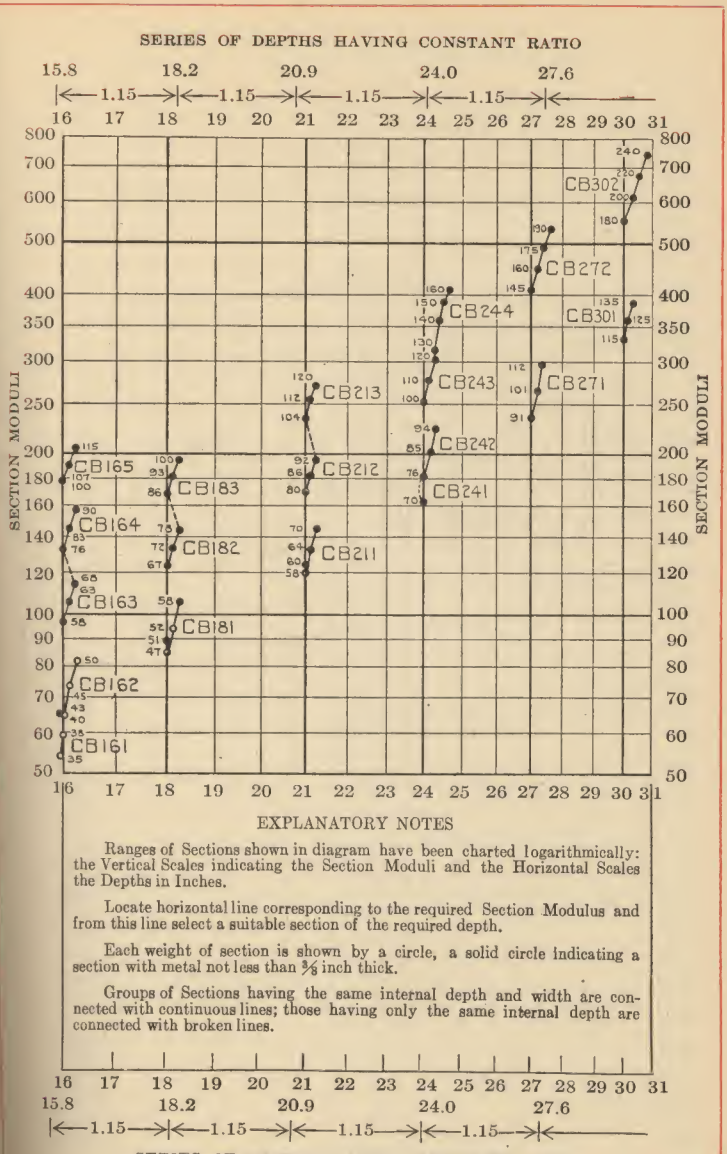
CARNEGIE
BEAM SECTIONS

ELEMENTS AND PROPERTIES

CARNEGIE BEAM SECTIONS

Range of Sections
Selected for use as Beams




SERIES OF DEPTHS HAVING CONSTANT RATIO
15.8
18.2
20.9
24.0
27.6
1.15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
800 700 600 500 400 350 300 250 200 180 160 140 120 100 90 80 70 60 50
SECTION MODULI
CB165
CB164
CB163
CB162
CB161
CB183
CB182
CB181
CB213
CB212
CB211
CB244
CB243
CB242
CB241
CB272
CB271
CB301
CB302
EXPLANATORY NOTES
Ranges of Sections shown in diagram have been charted logarithmically: the Vertical Scales indicating the Section Moduli and the Horizontal Scales the Depths in Inches.
Locate horizontal line corresponding to the required Section Modulus and from this line select a suitable section of the required depth.
Each weight of section is shown by a circle, a solid circle indicating a section with metal not less than 5/16 inch thick.
Groups of Sections having the same internal depth and width are connected with continuous lines; those having only the same internal depth are connected with broken lines.
SERIES OF DEPTHS HAVING CONSTANT RATIO

CARNEGIE BEAM SECTIONS

Beam Sections

Comparative Table of Section Moduli

Section Modulus	30 In.		27 In.		24 In.		21 In.		Section Modulus	24 In.		21 In.		18 In.		16 In.		14 In.	
	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.		Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
738	240								236			104							
676	220	CB 302							225	94			CB 213						
615	200								205							115			
553	180								203	85	CB 242								
535			190						196			92		100					
492			175	CB 272					191							107	CB 165		
450			160						184			86	CB 212		CB 183				
411					160				182	76				93					
408			145						178							100			
390	135	CB 301							171			80							
385					150	CB 244			168					86					
361	125								163	70								105	
359					140				157							90			CB 145
334					130				147		CB 241		CB 211					95	
332	115								145			70		78	CB 182	83	CB 164		
302				CB 271	120				133			64		72		76			
293			112						132									85	
277					110				124			60		67					
272						CB 243	120		120			58							CB 144
265			101					CB 213	115								CB 163	75	
254							112		114							68			
252					100														
238			91																

CARNEGIE BEAM SECTIONS—Continued

Beam Sections

Comparative Table of Section Moduli

Section Modulus	18 In.		16 In.		14 In.		12 In.		10 In.		Section Modulus	14 In.		12 In.		10 In.		9 In.		8 In.	
	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.		Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
110							100				47.8		CB 142					48			
105	58		63				91				47.6	33									
104					68						45.8			36							
100				CB 163		CB 144	83	CB 124			42.9							43			
97.1			58								41.8	30	CB 141						CB 93		
95.1		CB 181					75				40.7			32							
94.4	52										39.6			34	CB 122						
93.1					61						38.1					42					
89.9	51										37.9							38			
85.6					58						37.4									42	
85.4	47										35.6			28			CB 102				
81.9			50								35.1					36					
78.2				CB 162	53	CB 143					33.8							35			
73.8			45								32.7					31					
70.9					48						32.0								CB 92	36	CB 83
65.7			43								31.9					30					
65.6			40								30.9							32			
65.4							50	CB 123			30.7			25							
60.6					42						28.0							29			
60.1									63		27.6					26	CB 101				
59.3			38	CB 161							27.5									31	
58.8							45				26.3				CB 121					30	
56.6									56	CB 103	24.4					23					
56.3					39	CB 142					23.7									27	CB 82
54.7			35								21.7					21					
53.2									49		21.2							25			
52.3							40				21.1									24	
51.9					36						19.5							21	B 40		
51.1					38						15.9									21	B 39
											14.7									18	

CARNEGIE BEAM SECTIONS—Continued

Column Sections

Comparative Table of Radii of Gyration and Areas

Area	14 In.			12 In.			10 In.			Area
	Weight	r 2-2	No.	Weight	r 2-2	No.	Weight	r 2-2	No.	
89.70	305	4.14								89.70
86.76	295	4.13								86.76
83.82	285	4.12								83.82
80.87	275	4.10								80.87
77.93	265	4.09								77.93
74.99	255	4.08								74.99
72.06	245	4.06								72.06
69.11	235	4.05								69.11
67.64				230	3.74					67.64
66.17	225	4.04								66.17
64.70				220	3.73					64.70
63.23	215	4.03				CB 127				63.23
61.76				210	3.72					61.76
60.28	205	4.01								60.28
58.82				200	3.71					58.82
57.34	195	4.00								57.34
55.88				190	3.71					55.88
54.41	185	3.98								54.41
52.94			CB 146	180	3.64					52.94
51.47	175	3.97								51.47
50.00				170	3.65	CB 126				50.00
48.52	165	3.96								48.52
47.06				160	3.67					47.06
45.58	155	3.94								45.58
44.12				150	3.69					44.12
42.64	145	3.93								42.64
41.17				140	3.01		140	3.08		41.17
39.70	135	3.92								39.70
38.81							132	3.09		38.81
38.52	131	3.77								38.52
38.24				130	3.03	CB 125				38.24
36.75	125	3.90							CB 105	36.75
36.46							124	3.09		36.46
35.28				120	3.06					35.28
34.11							116	3.11		34.11
33.82	115	3.89								33.82
32.34				110	3.10					32.34
31.76							108	3.13		31.76
30.88	105	3.08	CB 145							30.88
29.40				100	2.39		100	3.16		29.40
27.93	95	3.06				CB 124				27.93
27.06							92	2.50	CB 104	27.06
26.76				91	2.41					26.76

CARNEGIE BEAM SECTIONS—Continued

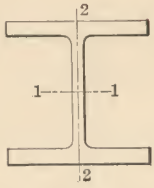
Column Sections

Comparative Table of Radii of Gyration and Areas

Area	14 In.			12 In.			10 In.			9 In.			8 In.			Area
	Wt.	r 2-2	No.	Wt.	r 2-2	No.	Wt.	r 2-2	No.	Wt.	r 2-2	No.	Wt.	r 2-2	No.	
26.47													90	2.17		26.47
24.99	85	3.05	CB 145													24.99
24.71													84	2.15		24.71
24.70						CB 124	84	2.48	CB 104							24.70
24.41				83	2.45											24.41
22.93													78	2.14		22.93
22.65							77	2.51								22.65
22.05	75	2.47	CB 144	75	2.51											22.05
21.17													72	2.12		21.17
20.59							70	2.55								20.59
19.99	68	2.46														19.99
19.40													66	2.11		19.40
18.53							63	2.14								18.53
17.94	61	2.44													CB 83	17.94
17.63													60	2.09		17.63
17.05	58	1.92							CB 103							17.05
16.47							56	2.20								16.47
15.87			CB 143										54	2.07		15.87
15.59	53	1.91				CB 123										15.59
14.69				50	1.98											14.69
14.41							49	2.27								14.41
14.12	48	1.90														14.12
14.11										48	2.29					14.11
14.10													48	2.06		14.10
13.23				45	1.97											13.23
12.65										43	2.28	CB 93				12.65
12.35	42	1.56					42	1.73								12.35
12.34													42	2.04		12.34
11.76			CB 142	40	1.95											11.76
11.47	39	1.56														11.47
11.17										38	2.26					11.17
10.59				36	1.55				CB 102							10.59
10.58	36	1.55					36	1.80					36	2.02		10.58
10.29										35	1.61					10.29
9.71	33	1.54				CB 122										9.71
9.40				32	1.54					32	1.60	CB 92				9.40
9.11							31	1.89								9.11
9.10													31	2.01		9.10
8.81													30	1.63		8.81
8.53										29	1.59				CB 82	8.53
8.22				28	1.53											8.22
7.93													27	1.62		7.93
7.06													24	1.61		7.06

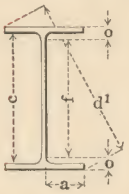
CARNEGIE BEAM SECTIONS—Continued

ELEMENTS OF SECTIONS DECIMAL

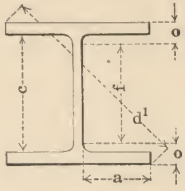


Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
CB 302 30″	240	70.58	30.781	14.218	.888	11356.0	737.9	12.69	766.9	107.9	3.30
	220	64.70	30.522	14.146	.816	10320.4	676.3	12.63	693.9	98.1	3.28
	200	58.82	30.263	14.073	.743	9305.7	615.0	12.58	622.7	88.5	3.25
	180	52.93	30.000	14.000	.670	8301.4	553.4	12.52	552.7	79.0	3.23
CB 301 30″	135	39.70	30.298	10.591	.621	5907.3	389.9	12.20	204.8	38.7	2.27
	125	36.75	30.148	10.546	.576	5441.7	361.0	12.17	187.4	35.5	2.26
	115	33.81	30.000	10.500	.530	4985.3	332.4	12.14	170.6	32.5	2.25
CB 272 27″	190	55.87	27.598	14.176	.756	7376.9	534.6	11.49	610.7	86.2	3.31
	175	51.47	27.400	14.118	.698	6746.8	492.5	11.45	556.6	78.9	3.29
	160	47.04	27.200	14.059	.639	6121.8	450.1	11.41	503.2	71.6	3.27
	145	42.64	27.000	14.000	.580	5508.7	408.1	11.37	451.0	64.4	3.25
CB 271 27″	112	32.94	27.340	9.855	.566	4007.6	293.2	11.03	148.0	30.0	2.12
	101	29.70	27.166	9.799	.510	3595.7	264.7	11.00	131.7	26.9	2.11
	91	26.76	27.000	9.750	.461	3217.0	238.3	10.97	116.9	24.0	2.09
CB 244 24″	160	47.06	24.664	14.123	.670	5065.7	410.8	10.38	526.0	74.5	3.34
	150	44.10	24.526	14.082	.629	4720.5	384.9	10.35	489.3	69.5	3.33
	140	41.16	24.388	14.041	.588	4380.4	359.2	10.32	453.1	64.5	3.32
	130	38.23	24.250	14.000	.547	4045.1	333.6	10.29	417.5	59.6	3.31
CB 243 24″	120	35.29	24.310	12.089	.539	3669.7	301.9	10.20	277.8	46.0	2.81
	110	32.34	24.156	12.044	.494	3343.5	276.8	10.17	252.2	41.9	2.79
	100	29.41	24.000	12.000	.450	3020.5	251.7	10.14	226.9	37.8	2.78
CB 242 24″	94	27.64	24.308	9.844	.499	2734.9	225.0	9.95	130.2	26.4	2.17
	85	24.99	24.154	9.797	.452	2457.2	203.5	9.92	116.2	23.7	2.16
	76	22.35	24.000	9.750	.405	2184.4	182.0	9.89	102.6	21.0	2.14
CB 241 24″	70	20.58	24.000	8.500	.400	1953.8	162.8	9.74	68.0	16.0	1.82
CB 213 21″	120	35.28	21.248	13.070	.535	2890.9	272.1	9.05	349.7	53.5	3.15
	112	32.93	21.126	13.034	.499	2683.7	254.1	9.03	324.3	49.8	3.14
	104	30.57	21.000	13.000	.465	2475.3	235.7	9.00	298.7	45.9	3.13
CB 212 21″	92	27.05	21.240	9.064	.502	2086.4	196.5	8.78	116.3	25.7	2.07
	86	25.28	21.120	9.032	.470	1939.3	183.6	8.76	107.7	23.8	2.06
	80	23.53	21.000	9.000	.438	1794.4	170.9	8.73	99.2	22.0	2.05
CB 211 21″	70	20.59	21.248	8.073	.433	1542.9	145.2	8.66	64.3	15.9	1.77
	64	18.82	21.126	8.036	.396	1403.3	132.9	8.64	58.2	14.5	1.76
	58	17.05	21.000	8.000	.360	1263.2	120.3	8.61	52.0	13.0	1.75
	60	17.64	21.034	8.015	.375	1304.9	124.1	8.60	53.7	13.4	1.75

CARNEGIE BEAM SECTIONS—Continued



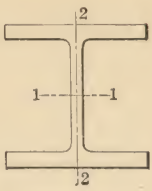
DIMENSIONS OF SECTIONS FRACTIONAL



Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thick-ness	Thick-ness	½ Thick-ness +	a	c	f	o	d¹	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
240	30¾	14 3/16	1 9/16	7/8	½	6 1/16	27 9/16	25½	2⅝	33 15/16	CB 302 30″
220	30½	14⅛	1 7/16	13/16	7/16	6 1/16	27 9/16	25½	2½	33⅝	
200	30¼	14 1/16	1 5/16	¾	⅜	6 1/16	27 9/16	25½	2⅜	33⅜	
180	30	14	1 3/16	11/16	⅜	6 1/16	27 9/16	25½	2¼	33⅛	
135	30 5/16	10⅝	1	5/8	5/16	5	28 3/16	26¾	1¾	32⅛	CB 301 30″
125	30⅛	10 9/16	15/16	9/16	5/16	5	28 3/16	26¾	1 1/16	31 15/16	
115	30	10½	⅞	½	5/16	5	28 3/16	26¾	1⅝	31 3/16	
190	27⅝	14 3/16	1¼	¾	7/16	6¾	25	23¼	2 3/16	31 1/16	CB 272 27″
175	27⅜	14⅛	1 3/16	11/16	⅜	6¾	25	23¼	2 1/16	30 13/16	
160	27 3/16	14 1/16	1 1/16	⅝	⅜	6¾	25	23¼	2	30⅝	
145	27	14	1	9/16	5/16	6¾	25	23¼	1 7/8	30 1/16	
112	27⅜	9⅞	15/16	9/16	5/16	4 1/16	25 7/16	24⅛	1⅝	29 1/16	CB 271 27″
101	27 3/16	9 13/16	13/16	½	5/16	4 1/16	25 7/16	24⅛	1½	28⅞	
91	27	9¾	¾	7/16	¼	4 1/16	25 7/16	24⅛	1 7/16	28 1/16	
160	24 1/16	14⅛	1⅛	1 1/16	⅜	6¾	22⅜	20¾	1 15/16	28 7/16	CB 244 24″
150	24½	14 1/16	1 1/16	5/8	⅜	6¾	22⅜	20¾	1⅞	28 1/16	
140	24⅜	14 1/16	1	9/16	5/16	6¾	22⅜	20¾	1 13/16	28⅛	
130	24¼	14	15/16	9/16	5/16	6¾	22⅜	20¾	1¾	28	
120	24 5/16	12 1/16	15/16	9/16	5/16	5 13/16	22¾	20¾	1¾	27 3/16	CB 243 24″
110	24⅛	12 1/16	⅞	½	¼	5 13/16	22⅜	20¾	1 1/16	27	
100	24	12	13/16	7/16	¼	5 13/16	22⅜	20¾	1⅝	26⅞	
94	24 5/16	9⅞	13/16	½	¼	4 1/16	22⅝	21⅜	1 7/16	26¼	CB 242 24″
85	24⅛	9 13/16	¾	7/16	¼	4 1/16	22⅝	21⅜	1⅜	26 1/16	
76	24	9¾	1 1/16	⅜	¼	4 1/16	22⅝	21⅜	1 5/16	25 15/16	
70	24	8½	1 1/16	⅜	¼	4 1/16	22⅝	21⅜	1 5/16	25½	CB 241 24″
120	21¼	13 1/16	15/16	9/16	5/16	6 5/16	19 5/16	17⅞	1 1/16	24 15/16	CB 213 21″
112	21⅛	13 1/16	⅞	½	¼	6 5/16	19 5/16	17⅞	1⅝	24 13/16	
104	21	13	13/16	7/16	¼	6 5/16	19 5/16	17⅞	1 9/16	24 1/16	
92	21¼	9 1/16	15/16	½	¼	4 5/16	19 5/16	17⅞	1 1/16	23⅛	CB 212 21″
86	21⅛	9 1/16	⅞	½	¼	4 5/16	19 5/16	17⅞	1⅝	23	
80	21	9	13/16	7/16	¼	4 5/16	19 5/16	17⅞	1 9/16	22⅞	
70	21¼	8 1/16	¾	7/16	¼	3 13/16	19¾	18⅝	1 5/16	22¾	CB 211 21″
64	21⅛	8 1/16	1 1/16	⅜	¼	3 13/16	19¾	18⅝	1¼	22⅝	
58	21	8	5/8	⅜	3/16	3 13/16	19¾	18⅝	1 3/16	22½	
60	21	8	5/8	⅜	3/16	3 13/16	19¾	18⅝	1 3/16	22½	

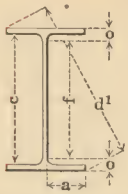
CARNEGIE BEAM SECTIONS—Continued

ELEMENTS
OF
SECTIONS
DECIMAL

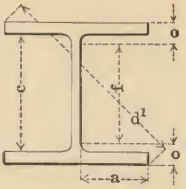


Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
CB 183 18″	100	29.40	18.238	12.069	.498	1783.4	195.6	7.79	253.4	42.0	2.94
	93	27.35	18.120	12.034	.463	1648.4	181.9	7.76	234.0	38.9	2.93
	86	25.29	18.000	12.000	.429	1514.1	168.2	7.74	214.7	35.8	2.91
CB 182 18″	78	22.94	18.242	8.565	.471	1318.8	144.6	7.58	90.9	21.2	1.99
	72	21.17	18.110	8.530	.436	1208.1	133.4	7.55	82.9	19.4	1.98
	67	19.69	18.000	8.500	.406	1117.1	124.1	7.53	76.4	18.0	1.97
CB 181 18″	58	17.05	18.252	7.573	.393	960.8	105.3	7.51	49.0	13.0	1.70
	52	15.30	18.114	7.534	.354	855.1	94.4	7.48	43.3	11.5	1.68
	47	13.82	18.000	7.500	.320	768.6	85.4	7.46	38.7	10.3	1.67
	51	15.00	18.024	7.555	.375	810.0	89.9	7.35	40.5	10.7	1.64
CB 165 16″	115	33.82	16.236	14.068	.532	1665.6	205.2	7.02	426.2	60.6	3.55
	107	31.46	16.110	14.032	.496	1537.2	190.8	6.99	393.9	56.1	3.54
	100	29.41	16.000	14.000	.464	1426.8	178.3	6.97	366.0	52.3	3.53
CB 164 16″	90	26.46	16.240	12.076	.495	1275.5	157.1	6.94	230.0	38.1	2.95
	83	24.41	16.120	12.039	.458	1167.7	144.9	6.92	210.4	35.0	2.94
	76	22.34	16.000	12.000	.419	1061.3	132.7	6.89	191.1	31.8	2.92
CB 163 16″	68	20.00	16.226	8.563	.438	923.7	113.9	6.80	81.3	19.0	2.02
	63	18.52	16.114	8.531	.406	849.9	105.5	6.77	74.6	17.5	2.01
	58	17.06	16.000	8.500	.375	776.6	97.1	6.75	68.0	16.0	2.00
CB 162 16″	50	14.70	16.254	7.072	.362	666.0	81.9	6.73	38.2	10.8	1.61
	45	13.23	16.128	7.036	.326	595.0	73.8	6.71	34.0	9.7	1.60
	40	11.75	16.000	7.000	.290	524.6	65.6	6.68	29.8	8.5	1.59
CB 161 16″	43	12.65	15.934	7.085	.375	523.8	65.7	6.44	28.9	8.2	1.51
	38	11.17	16.012	6.024	.314	475.1	59.3	6.52	19.2	6.4	1.31
	35	10.29	15.930	6.000	.290	435.5	54.7	6.50	17.5	5.8	1.30

CARNEGIE BEAM SECTIONS—Continued



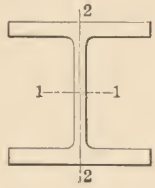
DIMENSIONS OF SECTIONS FRACTIONAL



Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
100	18¼	12 1/16	⅞	½	¼	5 13/16	16½	15⅛	1 9/16	21⅞	CB 183 18″
93	18⅛	12 1/16	13/16	7/16	¼	5 13/16	16½	15⅛	1½	21¾	
86	18	12	¾	7/16	¼	5 13/16	16½	15⅛	1 7/16	21⅝	
78	18¼	8 9/16	⅞	½	¼	4 1/16	16½	15⅛	1 9/16	20⅛	CB 182 18″
72	18⅛	8½	13/16	7/16	¼	4 1/16	16½	15⅛	1½	20	
67	18	8½	¾	3/8	¼	4 1/16	16½	15⅛	1 7/16	19 15/16	
58	18¼	7 9/16	11/16	3/8	¼	3⅝	16⅞	15⅞	1 3/16	19¾	
52	18⅛	7 9/16	⅝	3/8	5/16	3⅝	16⅞	15⅞	1⅛	19⅝	CB 181 18″
47	18	7½	9/16	5/16	5/16	3⅝	16⅞	15⅞	1 1/16	19½	
51	18	7 9/16	9/16	3/8	5/16	3⅝	16⅞	15⅞	1 1/16	19 9/16	
115	16¼	14 1/16	15/16	9/16	5/16	6 13/16	14⅜	13	1⅝	21½	CB 165 16″
107	16⅛	14	⅞	½	¼	6 13/16	14⅜	13	1 9/16	21⅜	
100	16	14	13/16	7/16	¼	6 13/16	14⅜	13	1½	21¼	
90	16¼	12 1/16	13/16	½	¼	5 13/16	14⅝	13⅜	1 7/16	20¼	CB 164 16″
83	16⅛	12 1/16	¾	7/16	¼	5 13/16	14⅝	13⅜	1⅜	20⅛	
76	16	12	11/16	7/16	¼	5 13/16	14⅝	13⅜	1 5/16	20	
68	16¼	8 9/16	¾	7/16	¼	4 1/16	14⅝	13⅜	1 7/16	18⅜	CB 163 16″
63	16⅛	8½	¾	3/8	¼	4 1/16	14⅝	13⅜	1⅜	18¼	
58	16	8½	11/16	3/8	5/16	4 1/16	14⅝	13⅜	1 5/16	18⅛	
50	16¼	7 1/16	⅝	3/8	5/16	3⅜	14 15/16	14	1⅛	17¾	
45	16⅛	7 1/16	9/16	5/16	5/16	3⅜	14 15/16	14	1 1/16	17⅝	CB 162 16″
40	16	7	½	5/16	5/16	3⅜	14 15/16	14	1	17½	
43	15 15/16	7 1/16	½	3/8	5/16	3⅜	14 15/16	14	1	17 1/16	
38	16	6	½	5/16	5/16	2⅞	14 15/16	14	1	17⅛	CB 161 16″
35	15 15/16	6	½	5/16	5/16	2⅞	14 15/16	14	15/16	17 1/16	

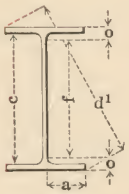
CARNEGIE BEAM SECTIONS—Continued

ELEMENTS OF SECTIONS DECIMAL

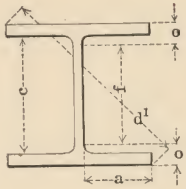


Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	305	89.70	16.890	16.000	1.406	4121.5	488.0	6.78	1539.1	192.4	4.14
	295	86.76	16.752	15.956	1.362	3948.1	471.4	6.75	1479.4	185.4	4.13
	285	83.82	16.614	15.912	1.318	3778.1	454.8	6.71	1420.7	178.6	4.12
	275	80.87	16.472	15.870	1.276	3607.8	438.1	6.68	1362.0	171.6	4.10
	265	77.93	16.332	15.826	1.232	3442.4	421.6	6.65	1304.2	164.8	4.09
	255	74.99	16.192	15.781	1.187	3280.0	405.1	6.61	1247.1	158.0	4.08
	245	72.06	16.050	15.738	1.144	3119.6	388.7	6.58	1190.6	151.3	4.06
	235	69.11	15.908	15.693	1.099	2961.9	372.4	6.55	1134.5	144.6	4.05
	225	66.17	15.764	15.650	1.056	2806.2	356.0	6.51	1079.1	137.9	4.04
	215	63.23	15.622	15.604	1.010	2654.7	339.9	6.48	1024.5	131.3	4.03
CB 146 14″	205	60.28	15.478	15.559	.965	2505.0	323.7	6.45	970.3	124.7	4.01
	195	57.34	15.334	15.513	.919	2358.2	307.6	6.41	916.8	118.2	4.00
	185	54.41	15.188	15.469	.875	2213.5	291.5	6.38	863.9	111.7	3.98
	175	51.47	15.042	15.424	.830	2071.7	275.5	6.34	811.6	105.2	3.97
	165	48.52	14.896	15.377	.783	1932.6	259.5	6.31	759.9	98.8	3.96
	155	45.58	14.750	15.330	.736	1796.8	243.6	6.28	709.0	92.5	3.94
	145	42.64	14.602	15.284	.690	1662.7	227.7	6.24	658.5	86.2	3.93
	135	39.70	14.452	15.239	.645	1530.4	211.8	6.21	608.4	79.9	3.92
	125	36.75	14.304	15.191	.597	1402.1	196.0	6.18	559.4	73.7	3.90
	115	33.82	14.154	15.145	.551	1275.9	180.3	6.14	510.9	67.5	3.89
	131	38.52	14.162	15.468	.874	1358.4	191.8	5.94	547.3	70.8	3.77
CB 145 14″	105	30.88	14.370	12.101	.536	1169.6	162.8	6.15	292.6	48.4	3.08
	95	27.93	14.186	12.050	.485	1044.0	147.2	6.11	262.0	43.5	3.06
	85	24.99	14.000	12.000	.435	921.3	131.6	6.07	232.0	38.7	3.05
CB 144 14″	75	22.05	14.382	10.086	.468	823.5	114.5	6.11	134.5	26.7	2.47
	68	19.99	14.238	10.043	.425	738.8	103.8	6.08	120.6	24.0	2.46
	61	17.94	14.094	10.000	.382	656.2	93.1	6.05	107.1	21.4	2.44
CB 143 14″	58	17.05	14.242	8.070	.413	609.4	85.6	5.98	62.8	15.6	1.92
	53	15.59	14.122	8.035	.378	552.5	78.2	5.95	56.8	14.1	1.91
	48	14.12	14.000	8.000	.343	496.0	70.9	5.93	50.8	12.7	1.90
CB 142 14″	42	12.35	14.240	6.822	.342	431.5	60.6	5.91	30.2	8.8	1.56
	39	11.47	14.160	6.798	.318	398.3	56.3	5.89	27.7	8.2	1.56
	36	10.58	14.080	6.774	.294	365.6	51.9	5.88	25.4	7.5	1.55
	33	9.71	14.000	6.750	.270	333.4	47.6	5.86	23.0	6.8	1.54
CB 141 14″	38	11.18	14.000	6.855	.375	357.5	51.1	5.66	24.2	7.1	1.47
	30	8.82	13.964	6.000	.270	292.0	41.8	5.75	15.5	5.2	1.33

CARNEGIE BEAM SECTIONS—Continued



DIMENSIONS OF SECTIONS FRACTIONAL



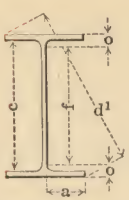
Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
305	16 7/8	16	2 1/4	1 3/8	3/4	7 5/16	12 3/8	11	2 15/16	23 5/16	
295	16 3/4	15 15/16	2 3/16	1 3/8	1 1/16	7 5/16	12 3/8	11	2 7/8	23 1/8	
285	16 5/8	15 15/16	2 1/8	1 5/16	1 1/16	7 5/16	12 3/8	11	2 13/16	23	
275	16 1/2	15 7/8	2 1/16	1 1/4	1 1/16	7 5/16	12 3/8	11	2 3/4	22 7/8	
265	16 5/16	15 13/16	2	1 1/4	5/8	7 5/16	12 3/8	11	2 11/16	22 3/4	
255	16 3/16	15 3/4	1 7/8	1 3/16	5/8	7 5/16	12 3/8	11	2 5/8	22 5/8	
245	16 1/16	15 3/4	1 13/16	1 1/8	5/8	7 5/16	12 3/8	11	2 9/16	22 1/2	
235	15 15/16	15 11/16	1 3/4	1 1/8	9/16	7 5/16	12 3/8	11	2 1/2	22 3/8	
225	15 3/4	15 5/8	1 11/16	1 1/16	9/16	7 5/16	12 3/8	11	2 3/8	22 1/4	
215	15 5/8	15 5/8	1 5/8	1	9/16	7 5/16	12 3/8	11	2 5/16	22 1/8	
205	15 1/2	15 9/16	1 9/16	15/16	1/2	7 5/16	12 3/8	11	2 1/4	21 15/16	CB 146 14″
195	15 5/16	15 1/2	1 1/2	15/16	1/2	7 5/16	12 3/8	11	2 3/16	21 13/16	
185	15 3/16	15 1/2	1 3/8	7/8	7/16	7 5/16	12 3/8	11	2 1/8	21 11/16	
175	15 1/16	15 7/16	1 5/16	13/16	7/16	7 5/16	12 3/8	11	2 1/16	21 9/16	
165	14 7/8	15 3/8	1 1/4	13/16	7/16	7 5/16	12 3/8	11	1 15/16	21 7/16	
155	14 3/4	15 5/16	1 3/16	3/4	3/8	7 5/16	12 3/8	11	1 7/8	21 5/16	
145	14 5/8	15 5/16	1 1/8	11/16	3/8	7 5/16	12 3/8	11	1 13/16	21 1/8	
135	14 7/16	15 1/4	1	5/8	3/8	7 5/16	12 3/8	11	1 3/4	21	
125	14 5/16	15 3/16	15/16	5/8	5/16	7 5/16	12 3/8	11	1 11/16	20 7/8	
115	14 1/8	15 1/8	7/8	9/16	5/16	7 5/16	12 3/8	11	1 9/16	20 3/4	
131	14 3/16	15 7/16	7/8	7/8	7/16	7 5/16	12 3/8	11	1 5/8	21	
105	14 3/8	12 1/8	1	9/16	5/16	5 13/16	12 3/8	11	1 11/16	18 13/16	CB 145 14″
95	14 3/16	12 1/16	7/8	1/2	1/4	5 13/16	12 3/8	11	1 5/8	18 5/8	
85	14	12	13/16	7/16	1/4	5 13/16	12 3/8	11	1 1/2	18 7/16	
75	14 3/8	10 1/16	13/16	7/16	1/4	4 13/16	12 3/4	11 5/8	1 3/8	17 9/16	CB 144 14″
68	14 1/4	10 1/16	1 1/16	7/16	1/4	4 13/16	12 3/4	11 5/8	1 5/16	17 7/16	
61	14 1/8	10	5/8	3/8	1/4	4 13/16	12 3/4	11 5/8	1 1/4	17 5/16	
58	14 1/4	8 1/16	1 1/16	7/16	1/4	3 7/8	12 3/4	11 5/8	1 5/16	16 3/8	CB 143 14″
53	14 1/8	8 1/16	5/8	5/8	1/4	3 7/8	12 3/4	11 5/8	1 1/4	16 1/4	
48	14	8	5/8	5/16	3/16	3 7/8	12 3/4	11 5/8	1 3/16	16 1/8	
42	14 1/4	6 13/16	9/16	5/16	3/16	3 1/4	13 1/16	12 1/4	1	15 13/16	
39	14 3/16	6 13/16	1/2	5/16	3/16	3 1/4	13 1/16	12 1/4	1	15 11/16	CB 142 14″
36	14 1/16	6 3/4	1/2	5/16	3/16	3 1/4	13 1/16	12 1/4	15/16	15 5/8	
33	14	6 3/4	7/16	1/4	3/16	3 1/4	13 1/16	12 1/4	7/8	15 9/16	
38	14	6 7/8	7/16	3/8	3/16	3 1/4	13 1/16	12 1/4	7/8	15 5/8	
30	13 15/16	6	7/16	1/4	3/16	2 7/8	13 1/16	12 1/4	7/8	15 3/16	CB 141 14″

CARNEGIE BEAM SECTIONS—Continued

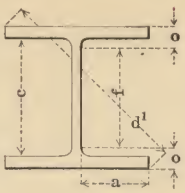
ELEMENTS OF SECTIONS DECIMAL

Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
CB 127 12″	230	67.64	12.000	14.980	1.980	1461.9	243.7	4.65	945.5	126.2	3.74
	220	64.70	12.000	14.735	1.735	1426.6	237.8	4.70	898.2	121.9	3.73
	210	61.76	12.000	14.490	1.490	1391.3	231.9	4.75	852.9	117.7	3.72
	200	58.82	12.000	14.245	1.245	1356.1	226.0	4.80	809.5	113.7	3.71
	190	55.88	12.000	14.000	1.000	1320.8	220.1	4.86	767.8	109.7	3.71
CB 126 12″	180	52.94	12.000	14.735	1.492	1218.1	203.0	4.80	702.4	95.3	3.64
	170	50.00	12.000	14.490	1.247	1182.8	197.1	4.86	666.9	92.1	3.65
	160	47.06	12.000	14.245	1.002	1147.5	191.3	4.94	633.0	88.9	3.67
	150	44.12	12.000	14.000	.757	1112.2	185.4	5.02	600.4	85.8	3.69
CB 125 12″	140	41.18	12.000	12.736	1.376	934.8	155.8	4.76	372.4	58.5	3.01
	130	38.24	12.000	12.491	1.131	899.5	149.9	4.85	350.5	56.1	3.03
	120	35.28	12.000	12.245	.885	864.1	144.0	4.95	329.6	53.8	3.06
	110	32.34	12.000	12.000	.640	828.8	138.1	5.06	309.9	51.6	3.10
CB 124 12″	100	29.41	12.000	10.613	1.121	659.0	109.8	4.73	167.5	31.6	2.39
	91	26.76	12.000	10.392	.900	627.2	104.5	4.84	155.9	30.0	2.41
	83	24.41	12.000	10.196	.704	598.9	99.8	4.95	147.0	28.8	2.45
	75	22.05	12.000	10.000	.508	570.7	95.1	5.09	138.5	27.7	2.51
CB 123 12″	50	14.69	12.258	8.071	.361	400.5	65.4	5.22	57.5	14.2	1.98
	45	13.23	12.130	8.036	.326	356.9	58.8	5.19	51.2	12.7	1.97
	40	11.76	12.000	8.000	.290	313.7	52.3	5.17	44.9	11.2	1.95
CB 122 12″	36	10.59	12.236	6.568	.308	280.1	45.8	5.14	25.4	7.7	1.55
	32	9.40	12.118	6.534	.274	246.3	40.7	5.12	22.3	6.8	1.54
	28	8.22	12.000	6.500	.240	213.4	35.6	5.10	19.2	5.9	1.53
CB 121 12″	34	9.99	12.022	6.635	.375	238.1	39.6	4.88	21.0	6.3	1.45
	25	7.34	11.924	6.000	.240	183.0	30.7	4.99	13.8	4.6	1.37

CARNEGIE BEAM SECTIONS—Continued



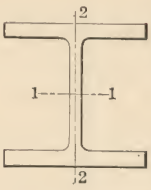
DIMENSIONS OF SECTIONS FRACTIONAL



Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
230	12	15	1 11/16	2	1	6 1/2	8 5/8	7 1/4	2 3/8	19 3/16	
220	12	14 3/4	1 11/16	1 3/4	7/8	6 1/2	8 5/8	7 1/4	2 3/8	19	CB 127 12″
210	12	14 1/2	1 11/16	1 1/2	3/4	6 1/2	8 5/8	7 1/4	2 3/8	18 13/16	
200	12	14 1/4	1 11/16	1 1/4	5/8	6 1/2	8 5/8	7 1/4	2 3/8	18 5/8	
190	12	14	1 11/16	1	1/2	6 1/2	8 5/8	7 1/4	2 3/8	18 7/16	
180	12	14 3/4	1 5/16	1 1/2	3/4	6 5/8	9 3/8	8	2	19	
170	12	14 1/2	1 5/16	1 1/4	5/8	6 5/8	9 3/8	8	2	18 13/16	CB 126 12″
160	12	14 1/4	1 5/16	1	9/16	6 5/8	9 3/8	8	2	18 5/8	
150	12	14	1 5/16	3/4	7/16	6 5/8	9 3/8	8	2	18 7/16	
140	12	12 3/4	1 1/16	1 3/8	3/4	5 11/16	9 13/16	8 5/8	1 11/16	17 1/2	
130	12	12 1/2	1 1/16	1 1/8	5/8	5 11/16	9 13/16	8 5/8	1 11/16	17 3/8	CB 125 12″
120	12	12 1/4	1 1/16	7/8	1/2	5 11/16	9 13/16	8 5/8	1 11/16	17 1/8	
110	12	12	1 1/16	5/8	3/8	5 11/16	9 13/16	8 5/8	1 11/16	17	
100	12	10 5/8	13/16	1 1/8	9/16	4 3/4	10 5/16	9 1/4	1 3/8	16	
91	12	10 3/8	13/16	7/8	1/2	4 3/4	10 5/16	9 1/4	1 3/8	15 7/8	CB 124 12″
83	12	10 3/16	13/16	11/16	3/8	4 3/4	10 5/16	9 1/4	1 3/8	15 3/4	
75	12	10	13/16	1/2	5/16	4 3/4	10 5/16	9 1/4	1 3/8	15 5/8	
50	12 1/4	8 1/16	5/8	3/8	3/16	3 7/8	10 15/16	9 7/8	1 3/16	14 1/16	CB 123 12″
45	12 1/8	8 1/16	9/16	5/16	3/16	3 7/8	10 15/16	9 7/8	1 1/8	14 9/16	
40	12	8	1/2	5/16	3/16	3 7/8	10 15/16	9 7/8	1 1/16	14 7/16	
36	12 1/4	6 9/16	9/16	5/16	3/16	3 3/16	11 1/8	10 3/8	15/16	13 7/8	
32	12 1/8	6 9/16	1/2	1/4	3/16	3 3/16	11 1/8	10 3/8	7/8	13 13/16	CB 122 12″
28	12	6 1/2	7/16	1/4	1/8	3 3/16	11 1/8	10 3/8	13/16	13 1/16	
34	12	6 5/8	7/16	3/8	3/16	3 3/16	11 1/8	10 3/8	13/16	13 3/4	
25	11 15/16	6	3/8	1/4	1/8	2 15/16	11 1/8	10 3/8	13/16	13 3/8	CB 121 12″

CARNEGIE BEAM SECTIONS—Continued

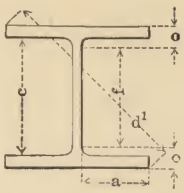
ELEMENTS OF SECTIONS DECIMAL



Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	140	41.17	10.000	13.177	1.777	623.2	124.6	3.89	391.4	59.4	3.08
	132	38.81	10.000	12.941	1.541	603.5	120.7	3.94	369.6	57.1	3.09
CB 105 10″	124	36.46	10.000	12.706	1.306	583.9	116.8	4.00	349.0	54.9	3.09
	116	34.11	10.000	12.471	1.071	564.3	112.9	4.07	329.4	52.8	3.11
	108	31.76	10.000	12.236	.836	544.8	109.0	4.14	310.7	50.8	3.13
	100	29.40	10.000	12.000	.600	525.1	105.0	4.23	292.8	48.8	3.16
	92	27.06	10.000	10.647	1.162	423.2	84.6	3.96	163.1	30.6	2.50
CB 104 10″	84	24.70	10.000	10.411	.926	403.6	80.7	4.04	152.0	29.2	2.48
	77	22.65	10.000	10.206	.721	386.5	77.3	4.13	142.9	28.0	2.51
	70	20.59	10.000	10.000	.515	369.3	73.9	4.24	134.3	26.9	2.55
	63	18.53	10.000	9.412	.787	300.4	60.1	4.03	85.2	18.1	2.14
CB 103 10″	56	16.47	10.000	9.206	.581	283.2	56.6	4.15	79.5	17.3	2.20
	49	14.41	10.000	9.000	.375	266.0	53.2	4.30	74.2	16.5	2.27
	42	12.35	10.000	8.324	.644	190.4	38.1	3.93	36.8	8.9	1.73
CB 102 10″	36	10.58	10.000	8.147	.467	175.6	35.1	4.07	34.4	8.5	1.80
	31	9.11	10.000	8.000	.320	163.4	32.7	4.23	32.5	8.1	1.89
	30	8.82	10.228	6.068	.298	163.2	31.9	4.30	18.5	6.1	1.45
CB 101 10″	26	7.64	10.098	6.029	.259	139.5	27.6	4.27	15.7	5.2	1.43
	23	6.76	10.000	6.000	.230	122.2	24.4	4.25	13.7	4.6	1.43
	21	6.17	9.902	6.000	.230	107.6	21.7	4.18	12.0	4.0	1.39
	48	14.11	9.242	9.082	.398	221.1	47.8	3.96	73.8	16.3	2.29
CB 93 9″	43	12.65	9.122	9.041	.357	195.5	42.9	3.93	65.4	14.5	2.28
	38	11.17	9.000	9.000	.316	170.4	37.9	3.91	57.1	12.7	2.26
	35	10.29	9.192	6.556	.335	155.4	33.8	3.89	26.6	8.1	1.61
CB 92 9″	32	9.40	9.096	6.528	.307	140.5	30.9	3.87	24.0	7.4	1.60
	29	8.53	9.000	6.500	.279	126.0	28.0	3.84	21.5	6.6	1.59

CARNEGIE BEAM SECTIONS—Continued

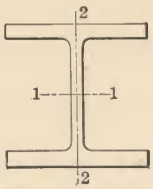
DIMENSIONS OF SECTIONS FRACTIONAL



Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
140	10	13 3/16	1	1 3/4	1 5/16	5 3/4	7 15/16	6 3/4	1 5/8	16 9/16	
132	10	12 15/16	1	1 9/16	1 3/16	5 3/4	7 15/16	6 3/4	1 5/8	16 3/8	
124	10	12 11/16	1	1 5/16	1 1/16	5 3/4	7 15/16	6 3/4	1 5/8	16 3/16	CB 105 10″
116	10	12 1/2	1	1 1/16	9/16	5 3/4	7 15/16	6 3/4	1 5/8	16	
108	10	12 1/4	1	13/16	7/16	5 3/4	7 15/16	6 3/4	1 5/8	15 13/16	
100	10	12	1	5/8	5/16	5 3/4	7 15/16	6 3/4	1 5/8	15 5/8	
92	10	10 5/8	13/16	13/16	5/8	4 3/4	8 3/8	7 3/8	1 5/16	14 5/8	
84	10	10 7/16	13/16	15/16	1/2	4 3/4	8 3/8	7 3/8	1 5/16	14 7/16	CB 104 10″
77	10	10 3/16	13/16	3/4	3/8	4 3/4	8 3/8	7 3/8	1 5/16	14 5/16	
70	10	10	13/16	1/2	5/16	4 3/4	8 3/8	7 3/8	1 5/16	14 3/16	
63	10	9 7/16	5/8	13/16	7/16	4 5/16	8 3/4	7 7/8	1 1/16	13 3/4	CB 103 10″
56	10	9 3/16	5/8	9/16	5/16	4 5/16	8 3/4	7 7/8	1 1/16	13 5/8	
49	10	9	5/8	3/8	3/16	4 5/16	8 3/4	7 7/8	1 1/16	13 1/2	
42	10	8 5/16	3/8	5/8	3/8	3 7/8	9 3/16	8 5/8	1 1/16	13 1/16	CB 102 10″
36	10	8 1/8	3/8	7/16	1/4	3 7/8	9 3/16	8 5/8	1 1/16	12 15/16	
31	10	8	3/8	5/16	3/16	3 7/8	9 3/16	8 5/8	1 1/16	12 13/16	
30	10 1/4	6 1/16	1/2	5/16	3/16	2 15/16	9 3/16	8 5/8	13/16	11 15/16	
26	10 1/8	6	7/16	1/4	3/16	2 15/16	9 3/16	8 5/8	3/4	11 13/16	CB 101 10″
23	10	6	3/8	1/4	1/8	2 15/16	9 3/16	8 5/8	1 1/16	11 1/16	
21	9 7/8	6	5/16	1/4	1/8	2 15/16	9 3/16	8 5/8	5/8	11 5/8	
48	9 1/4	9 1/16	9/16	3/8	1/4	4 3/8	8	7	1 1/8	13	
43	9 1/8	9 1/16	1/2	3/8	3/16	4 3/8	8	7	1 1/16	12 7/8	CB 93 9″
38	9	9	1/2	5/16	3/16	4 3/8	8	7	1	12 3/4	
35	9 3/16	6 9/16	9/16	5/16	3/16	3 1/8	8	7	1 1/8	11 5/16	
32	9 1/8	6 1/2	1/2	5/16	3/16	3 1/8	8	7	1 1/16	11 3/16	CB 92 9″
29	9	6 1/2	1/2	1/4	3/16	3 1/8	8	7	1	11 1/8	

CARNEGIE BEAM SECTIONS—Continued

ELEMENTS OF SECTIONS DECIMAL

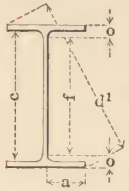


Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	90	26.47	9.606	8.520	.810	391.2	81.4	3.84	124.4	29.2	2.17
	84	24.71	9.456	8.469	.759	358.6	75.8	3.81	114.5	27.0	2.15
	78	22.93	9.302	8.418	.708	326.5	70.2	3.77	104.7	24.9	2.14
	72	21.17	9.150	8.366	.656	295.9	64.7	3.74	95.3	22.8	2.12
	66	19.40	8.994	8.314	.604	265.9	59.1	3.70	86.1	20.7	2.11
CB 83 8″	60	17.63	8.838	8.261	.551	237.1	53.7	3.67	77.1	18.7	2.09
	54	15.87	8.680	8.208	.498	209.2	48.2	3.63	68.3	16.6	2.07
	48	14.10	8.520	8.155	.445	182.2	42.8	3.59	59.7	14.6	2.06
	42	12.34	8.360	8.100	.390	156.2	37.4	3.56	51.4	12.7	2.04
	36	10.58	8.198	8.046	.336	131.3	32.0	3.52	43.4	10.8	2.02
	31	9.10	8.060	8.000	.290	110.9	27.5	3.49	36.7	9.2	2.01
CB 82 8″	30	8.81	8.196	6.559	.298	107.8	26.3	3.50	23.4	7.1	1.63
	27	7.93	8.098	6.529	.268	95.9	23.7	3.48	20.8	6.4	1.62
	24	7.06	8.000	6.500	.239	84.3	21.1	3.46	18.3	5.6	1.61

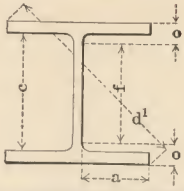
STANDARD MILL SECTIONS

Section Index and Nominal Depth	Weight per Foot	Area of Section	Depth of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	Lbs.	In.^{2}	In.	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
B 40 9″	25	7.34	9.000	5.380	.380	95.5	21.2	3.61	8.8	3.3	1.09
	21	6.17	9.000	5.250	.250	87.6	19.5	3.77	8.1	3.1	1.14
B 39 8″	21	6.17	8.000	5.110	.360	63.4	15.9	3.21	6.6	2.6	1.03
	18	5.29	8.000	5.000	.250	58.7	14.7	3.33	6.1	2.4	1.07
H 4 8″	37.7	11.00	8.000	8.125	.500	120.8	30.2	3.31	36.9	9.1	1.83
	34.3	10.00	8.000	8.000	.375	115.5	28.9	3.40	35.1	8.8	1.87
	32.6	9.50	8.000	7.938	.313	112.8	28.2	3.45	34.2	8.6	1.90
H 3A 6″	27.5	8.08	6.000	6.063	.438	49.3	16.4	2.47	16.0	5.3	1.41
	25.0	7.33	6.000	5.938	.313	47.0	15.7	2.53	14.9	5.0	1.43
H 3 6″	22.5	6.61	6.000	6.063	.375	41.0	13.7	2.49	12.2	4.0	1.36
	20.0	5.86	6.000	5.938	.250	38.8	12.9	2.57	11.4	3.8	1.39
H 2 5″	18.9	5.47	5.000	5.000	.313	23.8	9.5	2.08	7.8	3.1	1.20
H 1 4″	13.8	3.99	4.000	4.000	.313	10.7	5.3	1.64	3.6	1.8	0.95

CARNEGIE BEAM SECTIONS—Concluded



DIMENSIONS OF SECTIONS FRACTIONAL



Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thick-ness	Thick-ness	½ Thick-ness+	a	c	f	o	d^1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
90	9 5/8	8 1/2	1 3/16	13/16	7/16	3 7/8	7 3/16	6 1/4	1 13/16	12 7/8	
84	9 7/16	8 1/2	1 1/8	3/4	7/16	3 7/8	7 3/16	6 1/4	1 5/8	12 3/4	
78	9 5/16	8 7/16	1 1/16	1 1/16	3/8	3 7/8	7 3/16	6 1/4	1 9/16	12 9/16	
72	9 1/8	8 3/8	1	1 1/16	3/8	3 7/8	7 3/16	6 1/4	1 7/16	12 7/16	
66	9	8 5/16	7/8	5/8	5/16	3 7/8	7 3/16	6 1/4	1 3/8	12 1/4	
60	8 13/16	8 1/4	1 3/16	9/16	5/16	3 7/8	7 3/16	6 1/4	1 5/16	12 1/8	CB 83 8″
54	8 11/16	8 3/16	3/4	1/2	1/4	3 7/8	7 3/16	6 1/4	1 1/4	11 15/16	
48	8 1/2	8 1/8	1 1/16	7/16	1/4	3 7/8	7 3/16	6 1/4	1 1/8	11 13/16	
42	8 3/8	8 1/8	9/16	3/8	1/4	3 7/8	7 3/16	6 1/4	1 1/16	11 11/16	
36	8 5/16	8 1/16	1/2	5/16	3/16	3 7/8	7 3/16	6 1/4	1	11 1/2	
31	8 1/16	8	7/16	5/16	3/16	3 7/8	7 3/16	6 1/4	15/16	11 3/8	
30	8 5/16	6 9/16	1/2	5/16	3/16	3 3/16	7 3/16	6 1/4	1	10 1/2	
27	8 1/8	6 1/2	7/16	1/4	3/16	3 3/16	7 3/16	6 1/4	15/16	10 7/16	CB 82 8″
24	8	6 1/2	3/8	1/4	1/8	3 3/16	7 3/16	6 1/4	7/8	10 5/16	

STANDARD MILL SECTIONS

Weight per Foot	Depth of Section	Flange		Web		Distance					Section Index and Nominal Depth
		Width	Thick-ness	Thick-ness	½ Thick-ness+	a	c	f	o	d^1	
Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
25	9	5 3/8	3/8	3/8	1/4	2 1/2	...	7 1/2	3/4	10 1/2	B 40
21	9	5 1/4	3/8	1/4	1/8	2 1/2	...	7 1/2	3/4	10 7/16	9″
21	8	5 1/8	5/16	3/8	3/16	2 3/8	...	6 5/8	1 1/16	9 1/2	B 39
18	8	5	5/16	1/4	1/8	2 3/8	...	6 5/8	1 1/16	9 7/16	8″
37.7	8	8 1/8	7/16	1/2	1/4	3 13/16	...	6 1/4	7/8	11 7/16	H 4
34.3	8	8	7/16	3/8	3/16	3 13/16	...	6 1/4	7/8	11 5/16	8″
32.6	8	7 15/16	7/16	5/16	3/16	3 13/16	...	6 1/4	7/8	11 1/4	
27.5	6	6 1/16	1/2	7/16	1/4	2 13/16	...	4 1/4	7/8	8 9/16	H 3A
25.0	6	5 15/16	1/2	5/16	3/16	2 13/16	...	4 1/4	7/8	8 1/2	6″
22.5	6	6 1/16	3/8	3/8	3/16	2 7/8	...	4 7/16	3/4	8 9/16	H 3
20.0	6	5 15/16	3/8	1/4	1/8	2 7/8	...	4 7/16	3/4	8 1/2	6″
18.9	5	5	7/16	5/16	3/16	2 3/8	...	3 3/8	13/16	7 1/16	H 2 5″
13.8	4	4	3/8	5/16	3/16	1 7/8	...	2 1/2	3/4	5 11/16	H 1 4″

Dimensions for Flange Thickness of Standard Mill Sections are the averages between dimensions of toe and root of Flanges.

CARNEGIE
BEAM SECTIONS

BEAM AND COLUMN
SAFE LOADS

in accordance with Specifications of

AMERICAN INSTITUTE OF STEEL CONSTRUCTION—1923

SAFE LOADS FOR SECTIONS USED AS BEAMS

EXPLANATION OF TABLES

Tables of safe loads for Carnegie Beam Sections used as beams under conditions of static transverse loading, give the uniformly distributed safe loads in thousands of pounds for spans customary in bridge and building construction, based upon an extreme fiber stress of 18,000 pounds per square inch. These tables give the full loads for beams fixed or braced against lateral deflection as well as the reduced loads allowed for beams free or unbraced against side deflection, and also the values for those spans at which the allowed safe load will produce a deflection of $\frac{1}{360}$ of the span length. The loads in all cases include the weight of the section, which should be deducted in order to arrive at the net load which the section will support.

It is assumed in all cases that the loads are applied normal to the axis 1-1 as shown in the tables of elements of sections, and that the beam deflects vertically in the plane of bending only. If the conditions of loading involve the introduction of forces outside this plane of loading, the allowable safe loads must be determined from the general theory of flexure, in accordance with the mode of application of the load and its character. In cases of eccentric loading, the actual safe loads would be considerably lower than the tabulated safe loads which have been based upon the most favorable conditions of loading.

Vertical Deflection. The vertical deflection of a section under a uniformly distributed load is determined from formula:

Deflection, $D=\frac{5}{384}\frac{Wl^3}{EI}$; $\qquad Wl=8\,f\frac{I}{n}$

" $D=\frac{40}{384}\frac{fl^2}{En}$; $\qquad$ Span length in feet: $l=12L$

" $D=\frac{15\,fL^2}{En}$ inches

Steel, E=29,000,000; for fiber stress f=18,000 pounds:

$$\text{Deflection, } D=\frac{0.01862L^2}{2n}$$

n=distance from center line of gravity to extreme fiber:

$$\text{Deflection}=\frac{\text{Coefficient}}{2n}$$

Deflection Coefficients for Fiber Stress of 18,000 Pounds

Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000
1	0.019	16	4.767	31	17.894	46	39.401
2	0.074	17	5.381	32	19.068	47	41.133
3	0.168	18	6.033	33	20.278	48	42.902
4	0.298	19	6.722	34	21.526	49	44.708
5	0.466	20	7.448	35	22.810	50	46.552
6	0.670	21	8.212	36	24.132	51	48.432
7	0.912	22	9.012	37	25.492	52	50.350
8	1.192	23	9.850	38	26.888	53	52.306
9	1.508	24	10.726	39	28.322	54	54.298
10	1.862	25	11.638	40	29.793	55	56.328
11	2.253	26	12.588	41	31.301	56	58.395
12	2.681	27	13.574	42	32.847	57	60.499
13	3.147	28	14.599	43	34.430	58	62.640
14	3.650	29	15.660	44	36.050	59	64.819
15	4.190	30	16.759	45	37.707	60	67.035

The deflection, in inches, of sections subjected to transverse stresses due to uniformly distributed loads are obtained as follows:

Symmetrical Sections. To find the deflection in inches of a section symmetrical about the neutral axis, such as I- and H-beams, divide the coefficient in the table corresponding to given span and fiber stress by the depth of the section in inches.

Unsymmetrical Sections. To find the deflection in inches of a section not symmetrical about the neutral axis, such as beams with unbalanced flange plates or with continuous shelf angles, divide the coefficient corresponding to given span and fiber stress by twice the distance of extreme fiber from neutral axis obtained by computation.

Other Fiber Stresses. To find the deflection of any section for other fiber stresses than those given, multiply the coefficient for 18000 pounds fiber stress corresponding to the span given by the ratio of desired fiber stress and 18000.

Limits of Deflection. The deflection of floor beams carrying plastered ceilings should be limited to not more than $\frac{1}{360}$ of the span length; this limit is indicated in the safe load tables by lower zigzag line, is derived from the following formulas:

$$\text{Deflection, } D_{max.} = \frac{12L}{360} = \frac{15fL^2}{En} \qquad \text{Limiting Span, } L_{max.} = \frac{En}{450f}$$

for fiber stress of 18,000, Limiting Span, $L_{max.} = 3.580n$

Lateral Deflection of Beams. In computing safe loads it is generally assumed that the compression flanges of the sections are secured against lateral deflection by the use of tie rods or by other means.

In such cases full safe loads may be used up to a span length equal to fifteen times the flange width, but when the unbraced length exceeds this ratio, the full safe loads must be reduced in accordance with the ratios given in the following table in order to insure that the stresses in the compression flanges do not exceed the safe unit stress. The lateral unbraced length of beams and girders should not exceed forty times the width of the compression flanges.

The following table gives values obtained from formula of American Institute of Steel Construction: $f_c = \dfrac{20{,}000}{1 + \frac{1}{2000}(l/b)^2}$

Reduction of Safe Loads for Ratio of Span Length to Flange Width, l/b.

Ratio, l/b	Full Load, Per Cent.	Ratio, l/b	Full Load, Per Cent.	Ratio, l/b	Full Load, Per Cent.	Ratio, l/b	Full Load, Per Cent.
		21	91.0	27.5	80.6	34	70.4
15	99.9	21.5	90.3	28	79.8	34.5	69.7
15.5	99.2	22	89.5	28.5	79.0	35	68.9
16	98.5	22.5	88.7	29	78.2	35.5	68.2
16.5	97.8	23	87.9	29.5	77.4	36	67.4
17	97.1	23.5	87.1	30	76.6	36.5	66.7
17.5	96.4	24	86.3	30.5	75.8	37	66.0
18	95.6	24.5	85.5	31	75.1	37.5	65.2
18.5	94.9	25	84.7	31.5	74.3	38	64.5
19	94.1	25.5	83.9	32	73.5	38.5	63.8
19.5	93.4	26	83.0	32.5	72.7	39	63.1
20	92.6	26.5	82.2	33	71.9	39.5	62.4
20.5	91.8	27	81.4	33.5	71.2	40	61.7

In addition to this lateral deflection which is induced within the beam by the action of vertical loading, lateral deflection may be induced by the thrust of floor arches or other loading acting on an axis perpendicular to the line of principal bending stress.

Stresses due to horizontal thrust should either be neutralized by tie rods, or the safe carrying capacity of the beam should be computed in accordance with the general formulas of flexure to provide for the combined stresses due to the action of both vertical and horizontal forces; that is to say, the safe loads should be figured around both the axes 1-1 and 2-2, and the unit stress computed so as not to exceed the allowable fiber stress.

Effect of Impact on Stresses. The formulas upon which the tables of safe loads are based assume all loads to be quiescent or static. The effect of moving loads may be taken care of either by reducing the allowable unit stresses, or else by increasing the theoretical loads.

When a load is suddenly applied, the resultant stresses are twice as great as those due to an equal quiescent load.

When an instantaneously applied load produces impact or percussion, the resultant stresses are dynamic and are measured by the laws governing the energy of bodies in motion. The following formulas give the fiber stress and deflection due to a load falling on center of a beam rigidly supported at both ends when the weight of beam is negligible as compared with that of falling load, and when no account is taken of the local distortion due to impact or percussion at point of application of load; but when the weight of the beam is a real factor, theoretical formulas do not agree with observed results and practical tests give values which are far less than those indicated by theoretical formulas; this is notably true in drop-tests of axles:

W =Weight of falling load, in pounds.
h =Height of fall, in inches.
f =Extreme fiber stress due to static effect of load, W, in pounds per square inch.
f_d =Extreme fiber stress due to impact of load, W, in pounds per square inch.
D =Deflection due to static effect of load, W, in inches.
D_d=Deflection due to impact of load, W, in inches.

$$f_d = f\left(1 + \sqrt{\frac{2h}{D} + 1}\right) \qquad D_d = D\left(1 + \sqrt{\frac{2h}{D} + 1}\right)$$

Shearing Stresses. The safe load tables for beams are computed solely with reference to safe unit stresses due to flexure, and the safe loads uniformly distributed on the spans given will not produce excessive shearing stresses in the web.

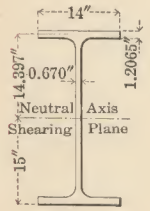
When, however, beams must support heavy loads which are concentrated near the supports, or when beams of short span are loaded with uniformly distributed loads to their full carrying capacity as regards flexure, the bending moments may be small in comparison with the reactions at the supports, and the beams may fail along the neutral plane as a result of longitudinal shearing stresses, or may buckle as a result of the combined longitudinal and vertical web stresses. On such spans the safe shearing or buckling strength of the web may limit the carrying capacity of the beam, so that the deciding factor will often be the resistance of the web to shearing stresses, rather than the resistance of the flanges to bending stresses.

Longitudinal Shear. At any point in any section of a beam, the horizontal and vertical components of the web stress are equal to each other and proportional to the vertical shear; their intensities are dependent upon the distance of the point from the neutral axis. In order to determine the intensity of the vertical shearing stress at a given point in a vertical section of the beam, therefore, it is sufficient to find the equal intensity of the horizontal shearing stress at the same point in the horizontal plane.

The longitudinal unit shear is zero at the upper and lower flanges of the beam and a maximum at the neutral plane. It is greatest at the supports and zero where there is no vertical shear.

The intensity of the longitudinal shear at any point in any section is the product of the vertical shear, V, for that section and the static moment, Ms, of the section included between the horizontal plane of shear through that point and the extreme fibers on the same side of the neutral plane divided by the product of the moment of inertia of the beam around the proper axis and the thickness at the plane of shear; or

$$\text{Longitudinal shear per square inch} = \frac{V\ Ms}{t\ I}.$$



Example—Required the maximum longitudinal unit shear in Carnegie Beam Section CB-302, 30″ x 14″, 180 lb. for a maximum vertical shear of 241,200 pounds.

Ms of Flange = 14 x 1.2065 x 14.397 = 243.2
Ms of Web = 13.794 x 0.67 x 6.897 = 63.7
Total Static Moment 306.9 in.^{3}
Moment of Inertia of Beam, I = 8301.4 in.^{4}

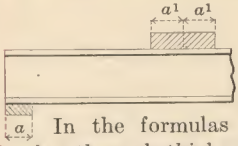
$$\text{Longitudinal Shear} = \frac{241200 \times 306.9}{8301.4 \times 0.67}$$

= 13,310 pounds per square inch.

Under usual conditions of loading, the longitudinal shear need not be taken into consideration.

Buckling Values of Beam Webs. The vertical shearing stresses or the vertical compressive components of the web stress may, under some conditions, exceed the safe resistance of the beam to buckling, and there remains the possibility that a web which is amply secure as against the safe allowed shear will not be of sufficient strength when considered as a column. In such cases provision must be made for security against buckling either by web stiffeners or by increasing the thickness of the web.

Experiments with beams of various depths and web thicknesses have demonstrated that the length of the web which can be assumed to resist buckling stresses is equal to the end bearing plus one fourth of the depth of the beam; the following formulas have been deduced:



Safe end reaction $R = f_b \times t \left(a + \frac{d}{4}\right)$

Safe interior load $W = 2f_b \times t \left(a^1 + \frac{d}{4}\right)$

In the formulas R is the end reaction, W the concentrated load, t the web thickness, d the depth of the beam, a^1 half the distance over which the concentrated load is applied, a the whole distance over which the end reaction is applied, and f_b is the safe unit resistance of the web to buckling.

The first formula is general and applies to any condition of loading. The second formula is for a single load concentrated at the center of a span; it can be extended for a system of concentrated loads, provided the sum of the distances a^1 is not less than a.

For computation of f_b the following formula has been used in the tables, corresponding to an allowable shearing stress of 12,000 pounds, f_b maximum = 15,000 pounds.

$$f = \frac{18000}{1 + \frac{1}{18000}(l/r)^2}, \quad l = \tfrac{1}{2}d \text{ and } r^2 = \tfrac{1}{12}t^2, \quad f_b = \frac{18000}{1 + \frac{1}{6000}(d/t)^2}$$

The tables give for beams with unsupported webs:

1. Allowed web resistance f_b, in pounds per square inch, computed from this compression formula.

2. The distance a, or the distance over which the end reaction must be distributed when the shearing stress, V, in the web is the maximum allowable of 12,000 pounds per square inch.

3. The allowable end reaction (R) when a is taken at $3\frac{1}{2}''$, which is the usual length of beam actually resting on the 4″ angles ordinarily used in building construction for beam seats.

4. The allowable shear V, on the gross area of beam webs at 12,000 pounds per square inch.

Maximum Bending Moments. In addition to data referring to maximum loads on beams as computed from the web resistance, these tables also give the maximum bending moments in foot pounds, which may be used instead of the table of properties, to ascertain the proper size section to be used in any particular instance.

CARNEGIE BEAM SECTIONS

Maximum Bending Moments and Web Resistances

Bending Stress 18,000 Pounds—Shearing Stress 12,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
	30.781	240	.888	1106,850	328,000	13.50	14,997	16.93	149,090
CB 302 30′	30.522	220	.816	1014,450	298,870	13.58	14,596	17.46	132,570
	30.263	200	.743	922,500	269,820	13.68	14,101	18.19	115,940
	30.000	180	.670	830,100	241,200	13.77	13,492	19.18	99,440
	30.298	135	.621	584,850	225,780	10.36	12,887	20.64	88,630
CB 301 30″	30.148	125	.576	541,500	208,380	10.39	12,358	21.74	78,560
	30.000	115	.530	498,600	190,800	10.45	11,734	23.18	68,410
	27.598	190	.756	801,900	250,370	12.81	14,729	15.59	115,800
CB 272 27″	27.400	175	.698	738,750	229,500	12.88	14,322	16.11	103,470
	27.200	160	.639	675,150	208,570	12.95	13,825	16.81	90,990
	27.000	145	.580	612,150	187,920	13.03	13,224	17.75	78,620
	27.340	112	.566	439,800	185,690	9.47	12,960	18.48	75,810
CB 271 27″	27.166	101	.510	397,050	166,260	9.55	12,221	19.88	64,140
	27.000	91	.461	357,450	149,360	9.57	11,453	21.54	54,120
	24.664	160	.670	616,200	198,300	12.43	14,684	13.99	95,100
CB 244 24″	24.526	150	.629	577,350	185,120	12.47	14,361	14.36	87,000
	24.388	140	.588	538,800	172,080	12.52	13,989	14.82	78,940
	24.250	130	.547	500,400	159,180	12.57	13,559	15.40	70,920
	24.310	120	.539	452,850	157,240	11.52	13,443	15.62	69,400
CB 243 24″	24.156	110	.494	415,200	143,200	11.60	12,871	16.48	60,650
	24.000	100	.450	377,550	129,600	11.65	12,211	17.59	52,200
	24.308	94	.499	337,500	145,560	9.27	12,899	16.54	61,640
CB 242 24″	24.154	85	.452	305,250	131,010	9.32	12,196	17.73	52,580
	24.000	76	.405	273,000	116,640	9.36	11,354	19.37	43,680
CB 241 24″	24.000	70	.400	244,200	115,200	8.48	11,250	19.60	42,750
	21.248	120	.535	408,150	136,410	11.97	14,253	12.58	67,190
CB 213 21″	21.126	112	.499	381,150	126,500	12.05	13,860	13.01	60,730
	21.000	104	.465	353,550	117,180	12.07	13,434	13.51	54,660
	21.240	92	.502	294,750	127,950	9.21	13,864	13.07	61,320
CB 212 21″	21.120	86	.470	275,400	119,120	9.25	13,468	13.54	55,580
	21.000	80	.438	256,350	110,380	9.29	13,014	14.11	49,880
	21.248	70	.433	217,800	110,400	7.89	12,845	14.54	49,010
CB 211 21″	21.126	64	.396	199,350	100,390	7.94	12,209	15.48	42,460
	21.000	58	.360	180,450	90,720	7.96	11,486	16.69	36,180
	21.034	60	.375	186,150	94,650	7.87	11,808	16.12	38,780

CARNEGIE BEAM SECTIONS—Continued

Maximum Bending Moments and Web Resistances

Bending Stress 18,000 Pounds—Shearing Stress 12,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq.In.	Inches	Pounds
CB 183 18″	18.238	100	.498	293,400	108,990	10.77	14,711	10.32	59,040
	18.120	93	.463	272,850	100,670	10.84	14,340	10.63	53,310
	18.000	86	.429	252,300	92,660	10.89	13,917	11.02	47,760
CB 182 18″	18.242	78	.471	216,900	103,100	8.41	14,400	10.64	54,670
	18.110	72	.436	200,100	94,750	8.45	13,980	11.02	48,930
	18.000	67	.406	186,150	87,700	8.49	13,558	11.43	44,040
CB 181 18″	18.252	58	.393	157,950	86,080	7.34	13,240	11.98	41,950
	18.114	52	.354	141,600	76,950	7.36	12,531	12.82	35,610
	18.000	47	.320	128,100	69,120	7.41	11,785	13.83	30,170
	18.024	51	.375	134,850	81,110	6.65	12,996	12.14	39,020
CB 165 16″	16.236	115	.532	307,800	103,650	11.88	15,000	8.93	60,320
	16.110	107	.496	286,200	95,890	11.94	15,000	8.86	56,000
	16.000	100	.464	267,450	89,090	12.01	15,000	8.80	52,200
CB 164 16″	16.240	90	.495	235,650	96,470	9.77	15,000	8.93	56,130
	16.120	83	.458	217,350	88,600	9.81	14,920	8.94	51,450
	16.000	76	.419	199,050	80,450	9.90	14,481	9.26	45,510
CB 163 16″	16.226	68	.438	170,850	85,280	8.01	14,649	9.24	48,480
	16.114	63	.406	158,250	78,510	8.06	14,257	9.54	43,580
	16.000	58	.375	145,650	72,000	8.09	13,810	9.90	38,840
CB 162 16″	16.254	50	.362	122,850	70,610	6.96	13,473	10.41	36,890
	16.128	45	.326	110,700	63,090	7.02	12,785	11.11	31,390
	16.000	40	.290	98,400	55,680	7.07	11,942	12.08	25,970
	15.934	43	.375	98,550	71,700	5.50	13,836	9.84	38,830
CB 161 16″	16.012	38	.314	88,950	60,330	5.90	12,558	11.30	29,590
	15.930	35	.290	82,050	55,440	5.92	11,977	11.98	25,990
CB 145 14″	14.370	105	.536	244,200	92,430	10.57	15,000	7.90	57,020
	14.186	95	.485	220,800	82,560	10.70	15,000	7.80	51,260
	14.000	85	.435	197,400	73,080	10.80	15,000	7.70	45,670
CB 144 14″	14.382	75	.468	171,750	80,770	8.51	15,000	7.91	49,810
	14.238	68	.425	155,700	72,610	8.58	15,000	7.83	45,000
	14.094	61	.382	139,650	64,610	8.65	14,671	8.01	39,360
CB 143 14″	14.242	58	.413	128,400	70,580	7.28	15,000	7.83	43,740
	14.122	53	.378	117,300	64,060	7.32	14,603	8.07	38,810
	14.000	48	.343	106,350	57,620	7.38	14,088	8.43	33,820

CARNEGIE BEAM SECTIONS—Continued

Maximum Bending Moments and Web Resistances

Bending Stress 18,000 Pounds—Shearing Stress 12,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
	14.240	42	.342	90,900	58,440	6.22	13,965	8.68	33,720
	14.160	39	.318	84,450	54,030	6.25	13,529	9.02	30,290
CB 142 14″	14.080	36	.294	77,850	49,670	6.27	13,022	9.46	26,880
	14.000	33	.270	71,400	45,360	6.30	12,430	10.02	23,490
	14.000	38	.375	76,650	63,000	4.87	14,607	8.00	38,340
CB 141 14″	13.964	30	.270	62,700	45,240	5.54	12,450	9.97	23,500
	12.000	100	1.121	164,700	161,420	4.08	15,000	6.60	109,300
CB 124 12″	12.000	91	.900	156,750	129,600	4.84	15,000	6.60	87,750
	12.000	83	.704	149,700	101,380	5.91	15,000	6.60	68,640
	12.000	75	.508	142,650	73,150	7.80	15,000	6.60	49,530
	12.258	50	.361	98,100	53,100	7.39	15,000	6.74	35,550
CB 123 12″	12.130	45	.326	88,200	47,450	7.43	14,625	6.92	31,140
	12.000	40	.290	78,450	41,760	7.51	14,004	7.28	26,400
	12.236	36	.308	68,700	45,220	6.08	14,251	7.24	28,790
CB 122 12″	12.118	32	.274	61,050	39,840	6.13	13,575	7.68	24,290
	12.000	28	.240	53,400	34,560	6.18	12,706	8.33	19,820
	12.022	34	.375	59,400	54,100	4.39	15,000	6.61	36,590
CB 121 12″	11.924	25	.240	46,050	34,340	5.36	12,753	8.24	19,840
	10.000	63	.787	90,150	94,440	3.82	15,000	5.50	70,830
CB 103 10″	10.000	56	.581	84,900	69,720	4.87	15,000	5.50	52,290
	10.000	49	.375	79,800	45,000	7.09	15,000	5.50	33,750
	10.000	42	.644	57,150	77,280	2.96	15,000	5.50	57,960
CB 102 10″	10.000	36	.467	52,650	56,040	3.76	15,000	5.50	42,030
	10.000	31	.320	49,050	38,400	5.11	15,000	5.50	28,800
	10.228	30	.298	47,850	36,570	5.23	15,000	5.63	27,070
CB 101 10″	10.098	26	.259	41,400	31,380	5.28	14,362	5.91	22,410
	10.000	23	.230	36,600	27,600	5.30	13,688	6.27	18,890
	9.902	21	.230	32,550	27,330	4.76	13,752	6.17	18,900

CARNEGIE BEAM SECTIONS—Concluded

Maximum Bending Moments and Web Resistances

Bending Stress 18,000 Pounds—Shearing Stress 12,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 93 9″	9.242	48	.398	71,700	44,140	6.50	15,000	5.08	34,690
	9.122	43	.357	64,350	39,080	6.59	15,000	5.02	30,950
	9.000	38	.316	56,850	34,130	6.66	15,000	4.95	27,250
CB 92 9″	9.192	35	.335	50,700	36,950	5.49	15,000	5.06	29,130
	9.096	32	.307	46,350	33,510	5.53	15,000	5.00	26,590
	9.000	29	.279	42,000	30,130	5.58	15,000	4.95	24,060
CB 83 8″	8.360	42	.390	56,100	39,120	5.74	15,000	4.60	32,700
	8.198	36	.336	48,000	33,050	5.81	15,000	4.51	27,970
	8.060	31	.290	41,250	28,050	5.88	15,000	4.43	23,990
CB 82 8″	8.196	30	.298	39,450	29,310	5.38	15,000	4.51	24,800
	8.098	27	.268	35,550	26,040	5.46	15,000	4.45	22,210
	8.000	24	.239	31,650	22,940	5.52	15,000	4.40	19,720

STANDARD MILL SECTIONS

B 40 9″	9.000	25	.380	31,800	41,040	3.10	15,000	4.95	32,770
	9.000	21	.250	29,250	27,000	4.33	14,803	5.05	21,280
B 39 8″	8.000	21	.360	23,850	34,560	2.76	15,000	4.40	29,700
	8.000	18	.250	22,050	24,000	3.68	15,000	4.40	20,620
H 4 8″	8.000	37.7	.500	45,300	48,000	3.78	15,000	4.40	41,250
	8.000	34.3	.375	43,350	36,000	4.82	15,000	4.40	30,940
	8.000	32.6	.313	42,300	30,050	5.63	15,000	4.40	25,820
H 3-A 6″	6.000	27.5	.438	24,600	31,540	3.12	15,000	3.30	32,850
	6.000	25.0	.313	23,550	22,540	4.18	15,000	3.30	23,480
H 3 6″	6.000	22.5	.375	20,550	27,000	3.04	15,000	3.30	28,130
	6.000	20.0	.250	19,350	18,000	4.30	15,000	3.30	18,750
H 2 5″	5.000	18.9	.313	14,250	18,780	3.04	15,000	2.75	22,300
H 1 4″	4.000	13.8	.313	7,950	15,020	2.12	15,000	2.20	21,130

CARNEGIE BEAM SECTIONS

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 302 30″x14″								CB 301 30″x10½″						
	240 lbs.		220 lbs.		200 lbs.		180 lbs.		135 lbs.		125 lbs.		115 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									452	452	417	417	382	382	
11									425	425	394	394	363	363	2.253
12									390	390	361	361	332	332	2.681
13	656	656	598	598	540	540	482	482	360	360	333	333	307	307	3.147
14	632	632	580	580	527	527	474	474	334	330	309	305	285	281	3.650
15	590	590	541	541	492	492	443	443	312	303	289	280	266	257	4.190
16	553	553	507	507	461	461	415	415	292	279	271	258	249	237	4.767
17	521	521	477	477	434	434	391	391	275	258	255	239	235	219	5.381
18	492	490	451	449	410	408	369	366	260	239	241	221	222	203	6.033
19	466	459	427	421	388	381	350	343	246	222	228	206	210	189	6.722
20	443	430	406	394	369	358	332	321	234	207	217	191	199	176	7.448
21	422	403	386	371	351	336	316	302	223	193	206	178	190	164	8.212
22	402	382	369	349	335	317	302	285	213	180	197	167	181	153	9.012
23	385	359	353	329	321	300	289	268	203	169	188	156	173	143	9.850
24	369	340	338	312	307	282	277	254	195	158	181	146	166	134	10.726
25	354	322	325	294	295	268	266	240	187	149	173	137	160	126	11.638
26	341	305	312	279	284	253	255	227	180	139	167	129	153	118	12.588
27	328	289	301	264	273	240	246	215	173	131	160	121	148	111	13.574
28	316	274	290	251	264	227	237	205	167	123	155	114	142	105	14.599
29	305	261	280	239	254	216	229	195	161	117	149	107	138	98	15.660
30	295	249	271	227	246	206	221	185	156	110	144	101	133	93	16.759
31	286	236	262	216	238	196	214	176	151	103	140	96	129	88	17.894
32	277	225	254	205	231	187	208	167	146	98	135	90	125	83	19.068
33	268	215	246	196	224	178	201	160	142	93	131	86	121	78	20.278
34	260	205	239	188	217	170	195	152	138	88	127	81	117	74	21.526
35	253	196	232	179	211	162	190	145	134	83	124	77	114	70	22.810
36	246	187	225	171	205	155	184	139	130		120		111		24.132
37	239	179	219	163	199	148	179	133	126		117		108		25.492
38	233	171	214	156	194	141	175	127	123		114		105		26.888
39	227	163	208	150	189	135	170	121	120		111		102		28.322
40	221	157	203	143	184	130	166	116	117		108		100		29.793
41	216	150	198	137	180	124	162	111	114		106		97		31.301
42	211	144	193	131	176	119	158	107	111		103		95		32.847
43	206	138	189	126	172	114	154	102	109		101		93		34.430
44	201	132	184	121	168	109	151	98	106		98		91		36.050
45	197	127	180	116	164	105	148	94	104		96		89		37.707
46	192	122	176	111	160	101	144	90	102		94		87		39.401
47	188	117	173	107	157	97	141		100		92		85		41.133
48	184		169		154		138		97		90		83		42.902
49	181		166		151		136		95		88		81		44.708
50	177		162		148		133		94		87		80		46.552
51	174		159		145		130		92		85		78		48.432
52	170		156		142		128		90		83		77		50.350
53	167		153		139		125		88		82		75		52.306
54	164		150		137		123		87		80		74		54.298
55	161		148		134		121		85		79		73		56.328
56	158		145		132		119		84		77		71		58.395
57	155		142		129		117		82		76		70		60.499
58	153		140		127		114		81		75		69		62.640

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 272 27″x14″								CB 271 27″x9¾″						
	190 lbs.		175 lbs.		160 lbs.		145 lbs.		112 lbs.		101 lbs.		91 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free.	Fixed	Free	
									371	371	333	333	299	299	
10									352	352	318	318	286	286	1.862
11									320	320	289	289	260	260	2.253
12	501	501	459	459	417	417			293	293	265	265	238	238	2.681
13	493	493	455	455	416	416	376	376	271	268	244	241	220	217	3.147
14	458	458	422	422	386	386	350	350	251	244	227	219	204	198	3.650
15	428	428	394	394	360	360	326	326	235	223	212	202	191	181	4.190
16	401	401	369	369	338	338	306	306	220	206	199	185	179	166	4.767
17	377	377	348	348	318	318	288	288	207	189	187	171	168	153	5.381
18	356	355	328	327	300	299	272	270	195	175	176	158	159	141	6.033
19	338	333	311	305	284	279	258	253	185	162	167	146	151	131	6.722
20	321	311	295	287	270	262	245	237	176	151	159	136	143	122	7.448
21	305	293	281	270	257	246	233	223	168	140	151	126	136	114	8.212
22	292	277	269	254	246	232	223	210	160	131	144	118	130	106	9.012
23	279	260	257	240	235	218	213	198	153	122	138	110	124	99	9.850
24	267	246	246	226	225	207	204	187	147	114	132	102	119	92	10.726
25	257	233	236	214	216	196	196	177	141	107	127	96	114	86	11.638
26	247	221	227	203	208	185	188	168	135	100	122	90	110	81	12.588
27	238	210	219	192	200	176	181	159	130	94	118	85	106	76	13.574
28	229	199	211	183	193	166	175	151	126	88	113	79	102	71	14.599
29	221	189	204	173	186	158	169	144	121	83	110	75	99	67	15.660
30	214	179	197	165	180	151	163	136	117	78	106	70	95	63	16.759
31	207	171	191	158	174	143	158	130	113	74	102	66	92	59	17.894
32	206	163	185	150	169	137	153	123	110	69	99	62	89	56	19.068
33	194	155	179	143	164	130	148	118	107		96		87		20.278
34	189	148	174	136	159	124	144	112	103		93		84		21.526
35	183	141	169	130	154	119	140	107	101		91		82		22.810
36	178	135	164	124	150	113	136	103	98		88		79		24.132
37	173	129	160	119	146	108	132	98	95		86		77		25.492
38	169	123	156	114	142	103	129	94	93		84		75		26.888
39	164	118	152	108	139	99	126	89	90		81		73		28.322
40	160	114	148	104	135	95	122	86	88		79		71		29.793
41	156	108	144	100	132	91	119	82	86		77		70		31.301
42	153	104	141	95	129	87	117	79	84		76		68		32.847
43	149	99	137	92	126	83	114	76	82		74		67		34.430
44	146	96	134	88	123	80	111	72	80		72		65		36.050
45	143	92	131	84	120	77	109	69	78		71		64		37.707
46	139	88	128	81	117	74	106	66	76		69		62		39.401
47	136	85	126	78	115	71	104		75		68		61		41.133
48	134		123		113		102		73		66		60		42.902
49	131		121		110		100		72		65		58		44.708
50	128		118		108		98		70		64		57		46.552
51	126		116		106		96		69		62		56		48.432
52	123		114												50.350

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot													Coefficient of Deflection
	CB 244 24″x14″								CB 243 24″x12″					
	160 lbs.		150 lbs.		140 lbs.		130 lbs.		120 lbs.		110 lbs.		100 lbs.	
	Laterally								Laterally					
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free
									314	314	286	286	259	259
12	397	397	370	370	344	344	318	318	302	302	277	277	252	252	2.681
13	379	379	355	355	332	332	308	308	279	279	256	256	232	232	3.147
14	352	352	330	330	308	308	286	286	259	259	237	237	216	216	3.650
15	329	329	308	308	287	287	267	267	242	242	221	221	201	201	4.190
16	308	308	289	289	269	269	250	250	226	223	208	205	189	186	4.767
17	290	290	272	272	254	254	235	235	213	208	195	190	178	172	5.381
18	274	273	257	255	239	238	222	221	201	193	185	176	168	160	6.033
19	259	255	243	239	227	223	211	207	191	180	175	165	159	150	6.722
20	246	239	231	224	216	209	200	194	181	168	166	154	151	140	7.448
21	235	225	220	210	205	196	191	182	173	158	158	144	144	131	8.212
22	224	212	210	198	196	185	182	172	165	148	151	135	137	123	9.012
23	214	200	201	188	187	174	174	162	158	139	144	127	131	115	9.850
24	205	189	192	177	180	165	167	153	151	131	138	119	126	109	10.726
25	197	179	185	167	172	156	160	145	145	123	133	112	121	102	11.638
26	190	170	178	158	166	148	154	137	139	116	128	106	116	96	12.588
27	183	160	171	150	160	140	148	130	134	110	123	100	112	91	13.574
28	176	153	165	143	154	133	143	123	129	104	119	95	108	86	14.599
29	170	145	159	135	149	126	138	117	125	98	115	90	104	81	15.660
30	164	138	154	129	144	121	133	111	121	93	111	85	101	77	16.759
31	159	131	149	123	139	114	129	106	117	88	107	80	97	73	17.894
32	154	125	144	117	135	109	125	101	113	84	104	75	94	69	19.068
33	149	119	140	112	131	104	121	96	110	79	101	71	92	66	20.278
34	145	113	136	106	127	99	118	92	107	75	98	68	89	63	21.526
35	141	108	132	102	123	94	114	88	104	72	95	64	86	59	22.810
36	137	104	128	97	120	90	111	84	101	68	92	61	84	57	24.132
37	133	99	125	93	117	87	108	80	98	65	90	58	82	54	25.492
38	130	95	122	88	113	82	105	77	95	62	87	55	79	51	26.888
39	126	90	118	85	111	79	103	73	93	59	85	53	77	49	28.322
40	123	87	115	80	108	75	100	70	91	56	83		76	47	29.793
41	120	83	113	78	105	72	98	67	88		81		74		31.301
42	117	80	110	75	103	69	95	64	86		79		72		32.847
43	115	76	107	71	100	66	93	62	84		77		70		34.430
44	112	73	105		98		91		82		75		69		36.050
45	110		103		96		89		81		74		67		37.707
46	107		100		94		87		79		72		66		39.401
47	105		98		92		85		77		71		64		41.133

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 242 24″x9¾″						CB 241 24″x8½″		CB 213 21″x13″						
	94 lbs.		85 lbs.		76 lbs.		70 lbs.		120 lbs		112 lbs.		104 lbs.		
	Laterally						Laterally		Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
9	291	291	262	262	233	233	230 217	230 217							1.508
10	270	270	244	244	218	218	195	195							1.862
11	245	245	222	222	199	199	178	176	273	273					2.253
12	225	225	203	203	182	182	163	158	272	272	253	253	234	234	2.681
13	208	205	188	185	168	166	150	143	251	251	235	235	218	218	3.147
14	193	187	174	169	156	151	140	130	233	233	218	218	202	202	3.650
15	180	171	163	155	146	138	130	118	218	218	203	203	189	189	4.190
16	169	158	153	142	137	127	122	108	204	204	191	191	177	177	4.767
17	159	145	144	131	128	117	115	99	192	191	179	178	166	164	5.381
18	150	134	136	121	121	108	109	91	181	177	169	166	157	154	6.033
19	142	124	129	112	115	100	103	84	172	166	160	155	149	143	6.722
20	135	115	122	104	109	93	98	78	163	156	152	145	141	134	7.448
21	129	108	116	97	104	87	93	72	155	146	145	136	135	126	8.212
22	123	100	111	90	99	81	89	67	148	137	139	128	129	119	9.012
23	117	94	106	84	95	75	85	62	142	129	133	120	123	111	9.850
24	113	88	102	79	91	70	81	57	136	122	127	114	118	105	10.726
25	108	82	98	74	87	66	78	54	131	115	122	107	113	99	11.638
26	104	77	94	69	84	62	75	50	126	109	117	101	109	94	12.588
27	100	72	90	65	81	58	72	47	121	103	113	96	105	89	13.574
28	96	68	87	61	78	54	70	44	117	97	109	91	101	84	14.599
29	93	64	84	57	75	51	67		113	92	105	86	98	80	15.660
30	90	60	81	54	73	48	65		109	88	102	82	94	76	16.759
31	87	57	79	51	70	45	63		105	83	98	78	91	72	17.894
32	84	53	76	48	68	43	61		102	79	95	74	88	68	19.068
33	82		74		66		59		99	75	92	70	86	65	20.278
34	79		72		64		57		96	72	90	67	83	62	21.526
35	77		70		62		56		93	68	87	64	81	59	22.810
36	75		68		61		54		91	65	85	61	79	56	24.132
37	73		66		59		53		88	62	82	58	76	54	25.492
38	71		64		57		51		86	59	80		74		26.888
39	69		63		56		50		84		78		73		28.322
40	68		61		55		49		82		76		71		29.793
41	66		60		53		48		80						31.301
42	64		58		52		47								32.847
43	63		57		51		45								34.430
44	61		55		50		44								36.050
45	60		54		49		43								37.707
46	59		53		47		42								39.401

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 212 21″x9″						CB 211 21″x8″								
	92 lbs.		86 lbs.		80 lbs.		70 lbs.		64 lbs.		60 lbs.		58 lbs.		
	Laterally						Laterally								
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
7							221	221	201	201	189	189	181	181	0.912
8							218	218	199	199	186	186	180	180	1.192
9	256	256	238	238	221	221	194	194	177	177	165	165	160	160	1.508
10	236	236	220	220	205	205	174	174	159	159	149	149	144	144	1.862
11	214	214	200	200	186	186	158	156	145	142	135	132	131	128	2.253
12	196	194	184	181	171	168	145	139	133	127	124	119	120	115	2.681
13	181	175	170	164	158	153	134	126	123	115	115	107	111	104	3.147
14	168	160	157	149	146	138	124	114	114	104	106	97	103	.94	3.650
15	157	146	147	136	137	127	116	103	106	94	99	88	96	85	4.190
16	147	134	138	125	128	116	109	94	100	86	93	80	90	78	4.767
17	139	123	130	115	121	106	103	86	94	79	88	73	85	71	5.381
18	131	114	122	106	114	98	97	79	89	72	83	67	80	65	6.033
19	124	105	116	98	108	91	92	73	84	67	78	62	76	60	6.722
20	118	97	110	91	103	84	87	67	80	61	74	57	72	55	7.448
21	112	90	105	84	98	78	83	62	76	57	71	53	69	51	8.212
22	107	83	100	78	93	73	79	57	72	52	68	49	66	47	9.012
23	103	78	96	73	89	67	76	53	69	49	65	45	63	44	9.850
24	98	73	92	67	85	63	73	49	66	45	62	42	60	41	10.726
25	94	68	88	63	82	59	70	46	64	42	60	39	58	38	11.638
26	91	63	85	59	79	55	67	43	61	39	57	36	56	35	12.588
27	87	59	82	55	76	51	65		59		55		53		13.574
28	84	56	79	52	73	48	62		57		53		52		14.599
29	81	52	76	48	71	45	60		55		51		50		15.660
30	79	49	73	46	68	42	58		53		50		48		16.759
31	76		71		66		56		51		48		47		17.894
32	74		69		64		54		50		47		45		19.068
33	71		67		62		53		48		45		44		20.278
34	69		65		60		51		47		44		42		21.526
35	67		63		59		50		46		43		41		22.810
36	65		61		57		48		44		41		40		24.132
37	64		60		55		47		43		40		39		25.492
38	62		58		54		46		42		39		38		26.888
39	60		57		53		45		41		38		37		28.322
40	59		55		51		44		40		37		36		29.793
41	58														31.301

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 183 18″x12″						CB 182 18″x8½″						
	100 lbs.		93 lbs.		86 lbs.		78 lbs.		72 lbs.		67 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							206	206	190	190	175	175	
9							193	193	178	178	165	165	1.508
10	218	218	201	201	185	185	174	174	160	160	149	149	1.862
11	213	213	198	198	184	184	158	156	146	144	135	134	2.253
12	196	196	182	182	168	168	145	141	133	130	124	120	2.681
13	181	181	168	168	155	155	133	127	123	117	115	109	3.147
14	168	168	156	156	144	144	124	116	114	106	106	99	3.650
15	156	156	146	146	135	135	116	105	107	97	99	90	4.190
16	147	144	136	134	126	124	108	96	100	89	93	83	4.767
17	138	134	128	125	119	115	102	88	94	81	88	76	5.381
18	130	125	121	116	112	107	96	81	89	75	83	69	6.033
19	124	116	115	108	106	100	91	75	84	69	78	64	6.722
20	117	109	109	101	101	93	87	69	80	64	74	59	7.448
21	112	102	104	95	96	88	83	64	76	59	71	55	8.212
22	107	96	99	89	92	82	79	60	73	55	68	51	9.012
23	102	90	95	83	88	77	75	55	70	51	65	47	9.850
24	98	85	91	78	84	73	72	51	67	47	62	44	10.726
25	94	80	87	74	81	68	69	48	64	44	60	41	11.638
26	90	75	84	70	78	64	67	45	62	41	57	38	12.588
27	87	71	81	66	75	61	64	42	59	38	55	36	13.574
28	84	67	78	62	72	58	62	39	57	36	53	33	14.599
29	81	64	75	59	70	54	60		55		51		15.660
30	78	60	73	56	67	52	58		53		50		16.759
31	76	57	70	53	65	49	56		52		48		17.894
32	73	54	68	50	63	46	54		50		47		19.068
33	71		66		61		53		49		45		20.278
34	69		64		59		51		47		44		21.526
35	67		62		58		50		46		43		22.810

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 181 18″x7½″								CB 165 16″x14″						
	58 lbs.		52 lbs.		51 lbs.		47 lbs.		115 lbs.		107 lbs.		100 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
7	172	172	154	154	162 154	162 154	138	138							0.912
8	158	158	142	142	135	135	128	128							1.192
9	140	140	126	126	120	120	114	114							1.508
10	126	125	113	112	108	106	102	101							1.862
11	115	111	103	99	98	94	93	90	207	207	192	192			2.253
12	105	99	94	89	90	85	85	80	205	205	191	191	178	178	2.681
13	97	89	87	80	83	76	79	72	189	189	176	176	165	165	3.147
14	90	80	81	72	77	69	73	65	176	176	164	164	153	153	3.650
15	84	73	76	65	72	62	68	59	164	164	153	153	143	143	4.190
16	79	67	71	59	67	57	64	54	154	154	143	143	134	134	4.767
17	74	61	67	54	63	52	60	49	145	145	135	135	126	126	5.381
18	70	55	63	49	60	47	57	45	137	136	127	126	119	118	6.033
19	66	51	60	45	57	43	54	41	130	127	121	118	113	111	6.722
20	63	47	57	42	54	40	51	38	123	120	114	111	107	103	7.448
21	60	43	54	38	51	37	49	35	117	112	109	104	102	97	8.212
22	57	40	52	35	49	34	47	32	112	106	104	98	97	92	9.012
23	55	37	49	33	47	31	45	30	107	100	100	93	93	87	9.850
24	53	34	47	30	45	29	43	27	103	94	95	88	89	82	10.726
25	51	32	45	28	43	27	41	25	98	89	92	83	86	77	11.638
26	49		44		41		39		95	84	88	78	82	73	12.588
27	47		42		40		38		91	80	85	75	79	69	13.574
28	45		40		39		37		88	76	82	71	76	66	14.599
29	44		39		37		35		85	72	79		74		15.660
30	42		38		36		34		82		76		71		16.759
31	41		37		35		33		79		74		69		17.894
32	39		35		34		32		77		72		67		19.068
33	38		34		33		31								20.278
34	37		33		32		30								21.526
35	36		32		31		29								22.810

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 164 16″x12″						CB 163 16″x8½″						
	90 lbs.		83 lbs.		76 lbs.		68 lbs.		63 lbs.		58 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							170.6	170.6	157.0	157.0	144.0	144.0	
9	192.9	192.9	177.2	177.2	160.9	160.9	151.8	151.8	140.6	140.6	129.4	129.4	1.508
10	188.5	188.5	173.9	173.9	159.2	159.2	136.6	136.6	126.6	126.6	116.5	116.5	1.862
11	171.4	171.4	158.1	158.1	144.7	144.7	124.2	123.2	115.1	114.1	105.9	105.0	2.253
12	157.1	157.1	144.9	144.9	132.7	132.7	113.9	110.9	105.5	102.4	97.1	94.2	2.681
13	145.0	145.0	133.7	133.7	122.5	122.5	105.1	100.1	97.4	92.7	89.6	85.4	3.147
14	134.6	134.6	124.2	124.2	113.7	113.7	97.6	91.1	90.4	84.1	83.2	77.4	3.650
15	125.7	125.7	115.9	115.9	106.1	106.1	91.1	82.9	84.4	76.8	77.7	70.4	4.190
16	117.8	116.0	108.7	107.0	99.5	98.0	85.4	75.7	79.1	70.1	72.8	64.6	4.767
17	110.9	107.6	102.3	99.3	93.6	90.9	80.4	69.7	74.5	64.2	68.5	59.1	5.381
18	104.7	100.1	96.6	92.4	88.4	84.6	75.9	64.0	70.3	59.2	64.7	54.3	6.033
19	99.2	93.4	91.5	86.1	83.8	78.9	71.9	58.8	66.6	54.5	61.3	50.2	6.722
20	94.2	87.6	86.9	80.5	79.6	73.7	68.3	54.5	63.3	50.3	58.2	46.3	7.448
21	89.8	82.1	82.8	75.4	75.8	69.0	65.1	50.4	60.3	46.7	55.5	42.7	8.212
22	85.7	77.0	79.0	70.7	72.4	64.7	62.1	46.9	57.5	43.2	53.0	39.7	9.012
23	82.0	72.3	75.6	66.4	69.2	60.8	59.4	43.4	55.0	40.0	50.6	36.8	9.850
24	78.5	68.1	72.4	62.5	66.3	57.2	56.9	40.3	52.7	37.3	48.5	34.2	10.726
25	75.4	64.1	69.5	58.9	63.7	53.9	54.7	37.7	50.6	34.7	46.6	31.9	11.638
26	72.5	60.5	66.9	55.5	61.2	50.8	52.6	35.0	48.7	32.5	44.8	29.7	12.588
27	69.8	57.1	64.4	52.4	59.0	48.0	50.6	32.8	46.9	30.2	43.1	27.8	13.574
28	67.3	54.0	62.1	49.6	56.9	45.4	48.8	30.6	45.2	28.2	41.6	26.0	14.599
29	65.0	51.1	60.0		54.9		47.1		43.6		40.2		15.660
30	62.8		58.0		53.1		45.5		42.2		38.8		16.759
31	60 8		56.1		51.4		44.1		40.8		37.6		17.894
32	58 9						42.7						19.068

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 162 16″ x 7″								CB 161 16″x6″				
	50 lbs.		45 lbs.		43 lbs.		40 lbs.		38 lbs.		35 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
					143.4	143.4			120.7	120.7	110.9	110.9	
6	141.2	141.2			131.7	131.7			118.4	118.4	109.4	109.4	0.670
7	140.4	140.4	126.2	126.2	112.9	112.9	111.4	111.4	101.5	101.5	93.8	93.8	0.912
8	122.9	122.9	110.7	110.7	98.8	98.8	98.4	98.4	88.8	87.5	82.1	80.8	1.192
9	109.2	108.7	98.4	97.9	87.8	87.4	87.5	86.8	79.0	75.5	73.0	69.8	1.508
10	98.3	95.4	88.6	86.0	79.0	76.7	78.7	76.1	71.1	65.8	65.7	60.8	1.862
11	89.3	84.4	80.5	76.1	71.8	67.9	71.6	67.6	64.6	57.8	59.7	53.4	2.253
12	81.9	75.5	73.8	67.8	65.8	60.7	65.6	60.2	59.2	51.1	54.7	47.2	2.681
13	75.6	67.6	68.1	60.7	60.8	54.4	60.6	53.9	54.7	45.4	50.5	41.9	3.147
14	70.2	60.8	63.3	54.6	56.4	48.9	56.2	48.5	50.8	40.5	46.9	37.4	3.650
15	65.5	54.9	59.0	49.5	52.7	44.2	52.5	43.8	47.4	36.3	43.8	33.5	4.190
16	61.4	49.8	55.4	44.8	49.4	40.2	49.2	39.7	44.4	32.8	41.0	30.2	4.767
17	57.8	45.5	52.1	40.7	46.5	36.5	46.3	36.0	41.8	29.6	38.6	27.2	5.381
18	54.6	41.4	49.2	37.1	43.9	33.3	43.7	33.0	39.5	26.8	36.5	24.6	6.033
19	51.7	37.8	46.6	33.9	41.6	30.4	41.4	30.1	37.4	24.3	34.6	22.3	6.722
20	49.1	34.6	44.3	31.2	39.5	28.0	39.4	27.6	35.5	22.1	32.8	20.3	7.448
21	46.8	31.7	42.2	28.6	37.6	25.6	37.5	25.3	33.8		31.3		8.212
22	44.7	29.3	40.3	26.3	35.9	23.6	35.8	23.2	32.3		29.8		9.012
23	42.7	27.0	38.5	24.2	34.4	21.7	34.2	21.4	30.9		28.5		9.850
24	41.0		36.9		32.9		32.8		29.6		27.4		10.726
25	39.3		35.4		31.6		31.5		28.4		26.3		11.638
26	37.8		34.1		30.4		30.3		27.3		25.3		12.588
27	36.4		32.8		29.3		29.2		26.3		24.3		13.574
28	35.1		31.6		28.2		28.1		25.4		23.5		14.599
29	33.9		30.5		27.2		27.1		24.5		22.6		15.660
30	32.8		29.5		26.3		26.2		23.7		21.9		16.759
31	31.7		28.6		25.5		25.4		22.9		21.2		17.894
32	30.7												19.068

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 145 14″x12″						CB 144 14″x10″						
	105 lbs.		95 lbs.		85 lbs.		75 lbs.		68 lbs.		61 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							161.5	161.5	145.2	145.2	129.2	129.2	
9							152.7	152.7	138.4	138.4	124.2	124.2	1.508
10	184.9	184.9	165.1	165.1	146.2	146.2	137.4	137.4	124.5	124.5	111.7	111.7	1.862
11	177.6	177.6	160.6	160.6	143.6	143.6	124.9	124.9	113.2	113.2	101.6	101.6	2.253
12	162.8	162.8	147.2	147.2	131.6	131.6	114.5	114.5	103.8	103.8	93.1	93.1	2.681
13	150.3	150.3	135.9	135.9	121.5	121.5	105.7	104.9	95.8	95.0	86.0	85.3	3.147
14	139.5	139.5	126.2	126.2	112.8	112.8	98.2	95.6	89.0	86.7	79.8	77.8	3.650
15	130.2	130.2	117.8	117.8	105.3	105.3	91.6	87.9	83.0	79.4	74.5	71.2	4.190
16	122.1	120.7	110.4	108.7	98.7	97.2	85.9	80.8	77.8	73.3	69.8	65.5	4.767
17	114.9	112.0	103.9	100.9	92.9	90.2	80.8	74.5	73.3	67.5	65.7	60.4	5.381
18	108.5	104.2	98.1	93.8	87.7	83.9	76.3	68.9	69.2	62.4	62.1	56.0	6.033
19	102.8	97.2	93.0	87.5	83.1	78.2	72.3	64.1	65.5	57.9	58.8	51.9	6.722
20	97.7	90.8	88.3	81.8	79.0	73.1	68.7	59.6	62.3	53.7	55.9	48.2	7.448
21	93.0	85.0	84.1	76.6	75.2	68.5	65.4	55.4	59.3	50.2	53.2	44.8	8.212
22	88.8	79.8	80.3	71.8	71.8	64.2	62.5	51.6	56.6	46.8	50.8	41.8	9.012
23	84.9	75.0	76.8	67.5	68.7	60.3	59.7	48.4	54.1	43.7	48.6	39.2	9.850
24	81.4	70.5	73.6	63.5	65.8	56.8	57.3	45.2	51.9	40.8	46.6	36.6	10.726
25	78.1	66.5	70.7	59.8	63.2	53.5	55.0	42.3	49.8	38.4	44.7	34.3	11.638
26	75.1		67.8		60.7		52.9		47.9		43 0		12.588
27	72.4		65.4		58.5		50.9		46.1		41.4		13.574
28	69.8		63.1		56.4		49.1		44.5		39.9		14.599

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 143 14″x8″						CB 142 14″x6¾″				
	58 lbs.		53 lbs.		48 lbs.		42 lbs.		39 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							116.9	116.9	108.1	108.1	
7	141.2	141.2	128.1	128.1	115.2	115.2	103.9	103.9	96.4	96.4	0.912
8	128.4	128.4	117.4	117.4	106.3	106.3	90.9	90.9	84.4	84.4	1.192
9	114.1	114.1	104.3	104.3	94.5	94.5	80.8	79.9	75.0	73.9	1.508
10	102.7	102.7	93.9	93.9	85.0	85.0	72.7	70.1	67.5	64.8	1.862
11	93.4	91.6	85.4	83.5	77.3	75.6	66.1	62.0	61.4	57.3	2.253
12	85.6	82.1	78.2	74.8	70.9	67.8	60.6	55.2	56.3	51.0	2.681
13	79.0	74.1	72.2	67.4	65.4	61.1	55.9	49.4	51.9	45.6	3.147
14	73.4	67.1	67.1	61.1	60.7	55.3	51.9	44.2	48.2	41.0	3.650
15	68.5	61.0	62.6	55.5	56.7	50.3	48.5	39.9	45.0	37.0	4.190
16	64.2	55.6	58.7	50.6	53.1	45.8	45.5	36.1	42.2	33.5	4.767
17	60.4	50.9	55.2	46.3	50.0	41.9	42.8	32.8	39.7	30.4	5.381
18	57.1	46.7	52.2	42.5	47.2	38.5	40.4	29.8	37.5	27.7	6.033
19	54.0	42.9	49.4	39.1	44.8	35.4	38.3	27.2	35.5	25.3	6.722
20	51.3	39.5	46.9	36.2	42.5	32.6	36.4	24.9	33.8	23.1	7.448
21	48.9	36.5	44.7	33.4	40.5	30.1	34.6	22.8	32.1	21.2	8.212
22	46.7	33.8	42.7	30.9	38.7	27.8	33.1	21.0	30.7	19.5	9.012
23	44.6	31.3	40.8	28.6	37.0	25.8	31.6		29.4		9.850
24	42.8	29.0	39.1	26.5	35.4	23.9	30.3		28.1		10.726
25	41.1	26.9	37.6	24.6	34.0	22.2	29.1		27.0		11.638
26	39.5		36.1		32.7		28.0		26.0		12.588
27	38.0		34.8		31.5		26.9		25.0		13.574
28	36.7		33.5		30.4		26.0		24.1		14.599

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 142 14″x6¾″						CB 141 14″x6″		
	38 lbs.		36 lbs.		33 lbs.		30 lbs.		
	Laterally						Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
4	126.0	126.0							0.298
5	122.6	122.6					90.5	90.5	0.466
6	102.1	102.1	99.3	99.3	90.7	90.7	83.6	83.6	0.670
7	87.5	87.5	89.0	89.0	81.7	81.7	71.7	71.7	0.912
8	76.6	76.6	77.9	77.9	71.5	71.5	62.7	61.8	1.192
9	68.1	67.3	69.2	68.2	63.5	62.6	55.8	53.3	1.508
10	61.3	59.0	62.3	59.8	57.2	54.9	50.2	46.5	1.862
11	55.7	52.2	56.7	52.9	52.0	48.5	45.6	40.8	2.253
12	51.1	46.5	51.9	47.1	47.6	43.2	41.8	36.1	2.681
13	47.1	41.6	47.9	42.1	44.0	38.6	38.6	32.1	3.147
14	43.8	37.4	44.5	37.9	40.8	34.6	35.8	28.6	3.650
15	40.9	33.8	41.6	34.2	38.1	31.2	33.5	25.6	4.190
16	38.3	30.6	39.0	30.9	35.7	28.2	31.4	23.0	4.767
17	36.0	27.8	36.7	28.1	33.6	25.6	29.5	20.8	5.381
18	34.0	25.3	34.6	25.4	31.8	23.3	27.9	18.8	6.033
19	32.3	23.1	32.8	23.2	30.1	21.3	26.4	17.0	6.722
20	30.6	21.1	31.2	21.2	28.6	19.5	25.1	15.5	7.448
21	29.2	19.4	29.7	19.5	27.2	17.9	23.9		8.212
22	27.9	17.8	28.3	17.9	26.0	16.4	22.8		9.012
23	26.6		27.1		24.9		21.8		9.850
24	25.5		26.0		23.8		20.9		10.726
25	24.5		24.9		22.9		20.1		11.638
26	23.6		24.0		22.0		19.3		12.588
27	22.7		23.1		21.2		18.6		13.574
28	21.9		22.3		20.4		17.9		14.599

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 124 12″x10″								CB 123 12″x8″				
	100 lbs.		91 lbs.		83 lbs.		75 lbs.		50 lbs.		45 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	322.8	322.8	259.2	259.2									
5	263.6	263.6	250.9	250.9	202.8	202.8							0.466
6	219.7	219.7	209.1	209.1	199.7	199.7							0.670
7	188.3	188.3	179.2	179.2	171.1	171.1	146.3	146.3	106.2	106.2	94.9	94.9	0.912
8	164.7	164.7	156.8	156.8	149.7	149.7	142.7	142.7	98.0	98.0	88.3	88.3	1.192
9	146.4	146.4	139.4	139.4	133.1	133.1	126.8	126.8	87.1	87.1	78.5	78.5	1.508
10	131.8	131.8	125.4	125.4	119.8	119.8	114.1	114.1	78.4	78.4	70.6	70.6	1.862
11	119.8	119.8	114.0	114.0	108.9	108.9	103.8	103.8	71.3	70.0	64.2	62.8	2.253
12	109.8	109.8	104.5	104.5	99.8	99.8	95.1	94.4	65.4	62.7	58.8	56.3	2.681
13	101.4	101.4	96.5	96.5	92.2	91.7	87.8	87.1	60.3	56.5	54.3	50.7	3.147
14	94.1	93.1	89.6	87.9	85.6	83.7	81.5	79.4	56.0	51.2	50.4	45.9	3.650
15	87.9	85.3	83.6	80.9	79.9	76.7	76.1	72.8	52.3	46.6	47.1	41.7	4.190
16	82.4	78.8	78.4	74.4	74.9	71.5	71.3	66.9	49.0	42.5	44.1	38.1	4.767
17	77.5	72.7	73.8	68.6	70.5	65.3	67.1	61.6	46.1	38.9	41.5	34.8	5.381
18	73.2	67.5	69.7	63.7	66.6	60.3	63.4	57.2	43.6	35.7	39.2	31.9	6.033
19	69.4	62.6	66.0	59.1	63.1	56.2	60.1	53.0	41.3	32.8	37.2	29.5	6.722
20	65.9	58.4	62.7	55.1	59.9	52.2	57.1	49.2	39.2	30.2	35.3	27.2	7.448
21	62.8	54.4	59.7	51.3	57.0	48.5	54.4	45.8	37.3	27.9	33.6	25.1	8.212
22	59.9		57.0		54.5		51.9		35.6		32.1		9.012
23	57.3		54.5		52.1		49.6		34.1		30.7		9.850
24	54.9		52.3		49.9		47.6		32.7		29.4		10.726

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 123 12″x8″		CB 122 12″x6½″								CB 121 12″x6″		
	40 lbs.		36 lbs.		34 lbs.		32 lbs.		28 lbs.		25 lbs.		
	Laterally		Laterally								Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
5					108.2 95.1	108.2 95.1					68.7	68.7	0.466
6			90.4	90.4	79.2	79.2	79.7	79.7	69.1	69.1	61.4	61.4	0.670
7	83.5	83.5	78.5	78.5	67.9	67.9	69.7	69.7	61.0	61.0	52.6	52.6	0.912
8	78.4	78.4	68.7	68.7	59.4	59.4	61.0	61.0	53.4	53.4	46.0	45.4	1.192
9	69.7	69.7	61.0	59.7	52.8	51.8	54.2	53.0	47.4	46.4	40.9	39.1	1.508
10	62.7	62.7	54.9	52.3	47.5	45.5	48.8	46.5	42.7	40.5	36.8	34.1	1.862
11	57.0	55.8	49.9	46.2	43.2	40.0	44.4	40.9	38.8	35.8	33.5	30.0	2.253
12	52.3	50.0	45.8	41.1	39.6	35.6	40.7	36.4	35.6	31.7	30.7	26.5	2.681
13	48.3	45.1	42.3	36.6	36.6	31.8	37.5	32.4	32.8	28.3	28.3	23.5	3.147
14	44.8	40.8	39.2	32.9	34.0	28.6	34.8	29.1	30.5	25.4	26.3	21.0	3.650
15	41.8	37.1	36.6	29.7	31.7	25.7	32.5	26.2	28.5	22.8	24.6	18.8	4.190
16	39.2	33.8	34.3	26.7	29.7	23.2	30.5	23.6	26.7	20.7	23.0	16.9	4.767
17	36.9	30.9	32.3	24.3	28.0	21.1	28.7	21.4	25.1	18.6	21.7	15.3	5.381
18	34.9	28.4	30.5	22.1	26.4	19.2	27.1	19.5	23.7	17.0	20.5	13.8	6.033
19	33.0	26.1	28.9	20.1	25.0	17.5	25.7	17.7	22.5	15.5	19.4	12.5	6.722
20	31.4	24.0	27.5	18.3	23.8	15.9	24.4	16.2	21.3	14.1	18.4	11.4	7.448
21	29.9	22.2	26.2	16.8	22.6	14.6	23.2	14.8	20.3	12.9	17.5		8.212
22	28.5		25.0		21.6		22.2		19.4		16.7		9.012
23	27.3		23.9		20.7		21.2		18.6		16.0		9.850
24	26.1		22.9		19.8		20.3		17.8		15.3		10.726

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 103 10″x9″						CB 102 10″x8″						
	63 lbs.		56 lbs.		49 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							154.6	154.6					
3	188.9	188.9					152.3	152.3	112.1	112.1			0.168
4	180.2	180.2	139.4	139.4			114.2	114.2	105.4	105.4			0.298
5	144.2	144.2	135.9	135.9			91.4	91.4	84.3	84.3	76.8	76.8	0.466
6	120.1	120.1	113.3	113.3			76.1	76.1	70.2	70.2	65.3	65.3	0.670
7	103.0	103.0	97.1	97.1	90.0	90.0	65.3	65.3	60.2	60.2	56.0	56.0	0.912
8	90.1	90.1	85.0	85.0	79.8	79.8	57.1	57.1	52.7	52.7	49.0	49.0	1.192
9	80.1	80.1	75.5	75.5	70.9	70.9	50.8	50.8	46.8	46.8	43.6	43.6	1.508
10	72.1	72.1	68.0	68.0	63.8	63.8	45.7	45.7	42.1	42.1	39.2	39.2	1.862
11	65.5	65.5	61.8	61.8	58.0	58.0	41.5	41.1	38.3	37.6	35.6	34.9	2.253
12	60.1	59.8	56.6	56.0	53.2	52.4	38.1	36.8	35.1	33.7	32.7	31.2	2.681
13	55.5	54.2	52.3	50.8	49.1	47.5	35.1	33.2	32.4	30.4	30.2	28.2	3.147
14	51.5	49.4	48.5	46.2	45.6	43.1	32.6	30.1	30.1	27.6	28.0	25.5	3.650
15	48.1	45.2	45.3	42.3	42.6	39.4	30.5	27.5	28.1	25.1	26.1	23.2	4.190
16	45.1	41.4	42.5	38.8	39.9	36.2	28.6	25.1	26.3	22.9	24.5	21.1	4.767
17	42.4	38.1	40.0	35.6	37.6	33.2	26.9	23.0	24.8	21.0	23.1	19.3	5.381
18	40.0		37.8		35.5		25.4		23.4		21.8		6.033
19	37.9		35.8		33.6		24.0		22.2		20.6		6.722
20	36.0		34.0		31.9		22.8		21.1		19.6		7.448

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 101 10″x6″								CB 93 9″x9″						
	30 lbs.		26 lbs.		23 lbs.		21 lbs.		48 lbs.		43 lbs.		38 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
4							54.7	54.7							0.298
5	73.1	73.1	62.8	62.8	55.2	55.2	52.2	52.2							0.466
6	63.8	63.8	55.3	55.3	48.9	48.9	43.5	43.5	88.3	88.3	78.2	78.2	68.3	68.3	0.670
7	54.7	54.7	47.4	47.4	41.9	41.9	37.3	37.3	82.0	82.0	73.5	73.5	64.9	64.9	0.912
8	47.9	47.3	41.4	41.8	36.7	36.1	32.6	32.1	71.8	71.8	64.3	64.3	56.8	56.8	1.192
9	42.6	40.8	36.8	35.2	32.6	31.2	29.0	27.7	63.8	63.8	57.2	57.2	50.5	50.5	1.508
10	38.3	35.6	33.2	30.7	29.3	27.1	26.1	24.2	57.4	57.4	51.4	51.4	45.4	45.4	1.862
11	34.8	31.3	30.1	27.0	26.7	23.8	23.7	21.2	52.2	52.2	46.8	46.8	41.3	41.3	2.253
12	31.9	28.6	27.6	23.8	24.4	21.1	21.7	18.8	47.8	47.3	42.9	42.2	37.9	37.3	2.681
13	29.5	24.6	25.5	21.3	22.6	18.7	20.1	16.7	44.2	42.7	39.6	38.3	35.0	33.8	3.147
14	27.4	21.9	23.7	19.0	20.9	16.7	18.6	14.9	41.0	38.9	36.7	34.9	32.5	30.7	3.650
15	25.5	19.7	22.1	17.0	19.5	15.0	17.4	13.3	38.3	35.6	34.3	31.8	30.3	28.1	4.190
16	23.9	17.7	20.7	15.3	18.3	13.5	16.3	12.0	35.9	32.5	32.2	29.1	28.4	25.7	4.767
17	22.5	16.0	19.5	13.8	17.2	12.1	15.3	10.8	33.8		30.3		26.7		5.381
18	21.3	14.5	18.4	12.5	16.3		14.5		31.9		28.6		25.2		6.033
19	20.2		17.5		15.4		13.7		30.2		27.1		23.9		6 722
20	19.2		16.6		14.7		13.0								7.448
21	18.2		15.8												8.212

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Concluded

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 92 9″x6½″						CB 83 8″x8″						
	35 lbs.		32 lbs.		29 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	73.9	73.9	67.0	67.0	60.3	60.3	78.2	78.2	66.1	66.1	56.1	56.1	
6	67.6	67.6	61.8	61.8	56.0	56.0	74.8	74.8	64.1	64.1	55.0	55.0	0.670
7	58.0	58.0	53.0	53.0	48.0	48.0	64.1	64.1	54.9	54.9	47.2	47.2	0.912
8	50.7	50.7	46.4	46.4	42.0	42.0	56.1	56.1	48.0	48.0	41.3	41.3	1.192
9	45.1	44.1	41.2	40.3	37.3	36.5	49.8	49.8	42.7	42.7	36.7	36.7	1.508
10	40.6	38.7	37.1	35.2	33.6	31.9	44.9	44.9	38.4	38.4	33.0	33.0	1.862
11	36.9	34.0	33.7	31.1	30.5	28.2	40.8	40.0	34.9	34.2	30.0	29.4	2.253
12	33.8	30.3	30.9	27.6	28.0	24.9	37.4	36.6	32.0	30.6	27.5	26.3	2.681
13	31.2	27.1	28.5	24.6	25.8	22.3	34.5	32.3	29.6	27.6	25.4	23.7	3.147
14	29.0	24.2	26.5	22.1	24.0	20.0	32.0	29.3	27.5	25.0	23.6	21.5	3.650
15	27.1	21.8	24.7	19.9	22.4	18.0	29.9	26.6	25.6		22.0		4.190
16	25.4	19.7	23.2	17.9	21.0	16.3	28.0		24.0		20.6		4.767
17	23.9		21.8		19.8		26.4		22.6		19.4		5.381
18	22.5		20.6		18.7		24.9						6.033
19	21.4		19.5		17.7								6.722

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 82 8″x6½″						*B 40 9″x5¼″				
	30 lbs.		27 lbs.		24 lbs.		25 lbs.		21 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							82.1	82.1			
4							63.7	63.7	54.0	54.0	0.298
5	58.6	58.6	52.1	52.1	45.9	45.9	50.9	50.9	46.7	46.7	0.466
6	52.6	52.6	47.3	47.3	42.1	42.1	42.4	42.4	38.9	38.9	0.670
7	45.1	45.1	40.6	40.6	36.1	36.1	36.4	36.1	33.4	32.9	0.912
8	39.5	39.5	35.5	35.5	31.6	31.6	31.8	30.6	29.2	27.8	1.192
9	35.1	34.3	31.6	30.9	28.1	27.5	28.3	26.2	26.0	23.8	1.508
10	31.6	30.1	28.4	27.0	25.3	24.0	25.5	22.7	23.4	20.6	1.862
11	28.7	26.5	25.8	23.8	23.0	21.2	23.1	19.8	21.2	17.9	2.253
12	26.3	23.5	23.7	21.2	21.1	18.8	21.2	17.4	19.5	15.7	2.681
13	24.3	21.1	21.9	18.9	19.4	16.8	19.6	15.3	18.0	13.8	3.147
14	22.6	18.9	20.3	16.9	18.1	15.1	18.2	13.6	16.7	12.3	3.650
15	21.1		18.9		16.9		17.0	12.1	15.6	10.9	4.190
16	19.7		17.8		15.8		15.9	10.8	14.6	9.7	4.767
17	18.6		16.7		14.9		15.0		13.7		5.381
18							14.1		13.0		6.033
19							13.4		12.3		6.722

*Standard Mill Section.
Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

STANDARD MILL SECTIONS

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	B 39 8″x5″				H 4 8″x8″						
	21 lbs.		18 lbs.		37.7 lbs.		34.3 lbs.		32.6 lbs.		
	Laterally				Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3	69.1 63.4	69.1 63.4	48.0	48.0	96.0	96.0					0.168
4	47.6	47.6	44.1	44.1	90.6	90.6	72.0	72.0			0.298
5	38.1	38.1	35.2	35.2	72.5	72.5	69.4	69.4	60.1	60.1	0.466
6	31.7	31.7	29.4	29.4	60.4	60.4	57.8	57.8	56.4	56.4	0.670
7	27.2	26.6	25.2	24.5	51.8	51.8	49.5	49.5	48.3	48.3	0.912
8	23.8	22.5	22.0	20.7	45.3	45.3	43.4	43.4	42.3	42.3	1.192
9	21.1	19.2	19.6	17.7	40.3	40.3	38.5	38.5	37.6	37.6	1.508
10	19.0	16.6	17.6	15.2	36.2	36.2	34.7	34.7	33.8	33.8	1.862
11	17.3	14.4	16.0	13.2	32.9	32.3	31.5	30.8	30.8	30.0	2.253
12	15.9	12.6	14.7	11.5	30.2	29.0	28.9	27.6	28.2	26.9	2.681
13	14.6	11.1	13.6	10.1	27.9	26.1	26.7	24.9	26.0	24.2	3.147
14	13.6	9.8	12.6	9.0	25.9	23.7	24.8	22.6	24.2	21.9	3.650
15	12.7		11.7		24.2		23.1		22.6		4.190
16	11.9		11.0		22.7		21.7		21.2		4.767
17	11.2		10.4		21.3		20.4		19.9		5.381

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	H 3 A 6″x6″				H 3 6″x6″				H 2 5″x5″		H 1 4″x4″		
	27.5 lbs.		25 lbs.		22.5 lbs.		20 lbs.		18.9 lbs.		13.8 lbs.		
	Laterally				Laterally				Laterally		Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3	63.1	63.1			54.0	54.0			37.6	37.6	30.0 21.2	30.0 21.2	0.168
4	49.3	49.3	45.1	45.1	41.0	41.0	36.0	36.0	28.5	28.5	15.9	15.9	0.298
5	39.4	39.4	37.6	37.6	32.8	32.8	31.0	31.0	22.8	22.8	12.7	12.7	0.466
6	32.9	32.9	31.4	31.4	27.4	27.4	25.9	25.9	19.0	19.0	10.6	10.1	0.670
7	28.2	28.2	26.9	26.9	23.4	23.4	22.2	22.2	16.3	15.9	9.1	8.3	0.912
8	24.6	24.4	23.5	23.1	20.5	20.3	19.4	19.0	14.3	13.4	8.0		1.192
9	21.9	21.0	20.9	19.9	18.2	17.5	17.2	16.4	12.7		7.1		1.508
10	19.7	18.3	18.8	17.3	16.4	15.3	15.5	14.3	11.4		6.4		1.862
11	17.9		17.1		14.9		14.1		10.4				2.253
12	16.4		15.7		13.7		12.9						2.681
13	15.2		14.5		12.6		11.9						3.147

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

COLUMNS AND STRUTS

A compression member, subjected to longitudinal pressure, is shortened by the compression and also tends to deflect laterally, due to the fact that the load cannot be applied coincident with the longitudinal axis and that the material is not perfectly homogeneous. This flexure occurs generally in the direction of the least resisting moment of the section; the load which will cause a column to fail decreases in the ratio of length to least lateral resistance of the section, the ultimate failure being the result of combined stresses due to compression, transverse shear and flexure.

Column Formulas. Under ideal conditions, when it can be assumed that the load is applied axially and that the material is perfectly homogeneous, the resistance of the column would equal its resistance to compressive forces up to the elastic limit, and there would not be any flexure; if, however, a deflection be imparted to the column by a lateral force, the column would ultimately fail by bending.

Euler's Formula, $P=k\frac{\pi^2 E I}{l^2}$ or $\frac{P}{A}=k\frac{\pi^2 E}{(l/r)^2}$, is based upon the foregoing theory, and gives results close to the ultimate strength found for long and slender struts, when k is a constant varying with the condition of end bearing, (k=4 for columns fixed both ends). For shorter and heavier columns, or for lower ratios of l/r the results do not correspond with actual tests.

Rankine's Formula, $P=\frac{Af}{1+c\,(l/r)^2}$ or $\frac{P}{A}=\frac{f}{1+c\,(l/r)^2}$, represents the type of formula now in general use and the various formulas for proportioning columns which are based upon this general formula agree with actual tests within certain limits. In this formula a certain compressive unit stress for direct crushing is assumed and reduced in ratio of length of column and least radius of gyration, l/r; value of c is an empirical factor, varying with the resistance of the material and with conditions of end bearing.

Straight Line Formulas. In practice, compression members of a greater ratio of slenderness, l/r, than 120 are rarely used, and within this limit the curve can be represented by a straight line, the general formula assuming the simpler form: $\frac{P}{A}=f-c\,(\frac{l}{r})$.

Compression formulas determining the resistance of webs in rolled beams or riveted girders against buckling, or the necessary reduction of safe loads due to lateral deflection of unbraced beams, are likewise based on one or the other type of column formulas.

Ratio of Slenderness. l/r is ratio of the unsupported length of a compression member to its radius of gyration, generally the least radius, excepting when the unsupported length is rigidly braced to prevent deflection in the direction which corresponds to the least radius of gyration. It is, therefore, necessary to determine the radii of gyration and to use the proper ratio of slenderness in any particular case.

Usual practice limits the maximum ratio of l/r for main members under permanent stress, permitting a higher ratio for secondary members under temporary stress, as in wind bracing.

Compressive Unit Stresses. The tables of allowable loads of column sections have been computed in accordance with the formula for steel columns of American Institute of Steel Construction—1923,

$$f = \frac{18{,}000}{1 + \frac{1}{18{,}000}(l/r)^2},$$

Maximum unit stress at l/r=60 : 15,000 lb. per sq. inch.
Maximum l/r: Primary members=120; Secondary members=200.

Combined Bending and Compression Stresses. Generally the loads are concentric and equally distributed over the cross section of the column or balanced on opposite sides thereof. In the case of beams carried on brackets or other forms of eccentric loading, bending stresses are produced which should be taken into consideration and the column sections so proportioned that the combined stresses do not exceed the allowable axial compressive stress.

W =Concentric load. W_1=Eccentric load.
M =Bending moment due to eccentric load=$W_1 x$.
I =Moment of inertia in direction of bending.
n =Distance from extreme fiber in direction of bending.
A =Area of column section, in square inches.
f =Allowable axial unit stress; f should be equal to or greater than $\frac{W + W_1}{A} + \frac{Mn}{I}$, the fiber stresses due to compression and bending respectively.

EXAMPLE:—Required a beam column, 25 feet long, to sustain a balanced load of 220,000 pounds and an eccentric load of 40,000 pounds applied 17 inches from the column center on axis 1-1.

Assume Carnegie Beam Section CB-165, 16″x14″, 100 lb.

$A = 29.41$ $I_{1\text{-}1} = 1426.8$ $r_{2\text{-}2} = 3.53$ $l/r = 25 \times 12 \div 3.53 = 85$

Actual fiber stress $= \frac{220{,}000 + 40{,}000}{29.41} + \frac{40{,}000 \times 17 \times 8}{1426.8} = 12{,}653$ pounds.

This stress is within the limits of the allowable fiber stress for ratio of l/r = 85, 12,844 pounds, obtained from the column formula.

Allowable Unit Stresses in Pounds per Square Inch

by Compression Formula of

American Institute of Steel Construction: $$f = \frac{18{,}000}{1 + \frac{1}{18{,}000}(l/r)^2}$$

The following tables give the unit stresses for ratios of l/r in intervals of 5/10. Intermediate values may be found by interpolation from the figures given for the tenth units of l/r by adding or deducting from the nearest tabulated figure the corresponding multiple.

Example: Unit stress for l/r=94.7 and l/r=150.8

l/r= 94.7 11989 +3x8.4 or 12031—2x8.4=12014

l/r=150.8 7941 +2x5.9 or 7971—3x5.9= 7953

MAIN MEMBERS—Ratios of l/r up to 120

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
60	15000		75	13714		90	12414		105	11163	
.5	14958	8.4	.5	13671	8.7	.5	12371	8.6	.5	11122	8.1
61	14916		76	13627		91	12328		106	11082	
.5	14874	8.4	.5	13584	8.7	.5	12286	8.5	.5	11042	8.0
62	14832		77	13540		92	12243		107	11002	
.5	14790	8.4	.5	13496	8.7	.5	12201	8.5	.5	10962	8.0
63	14748		78	13453		93	12158		108	10922	
.5	14705	8.5	.5	13409	8.7	.5	12116	8.5	.5	10883	7.9
64	14663		79	13366		94	12073		109	10843	
.5	14621	8.5	.5	13322	8.7	.5	12031	8.4	.5	10804	7.9
65	14578		80	13279		95	11989		110	10764	
.5	14535	8.5	.5	13235	8.7	.5	11947	8.4	.5	10725	7.9
66	14493		81	13192		96	11905		111	10686	
.5	14450	8.6	.5	13148	8.7	.5	11863	8.4	.5	10647	7.8
67	14407		82	13105		97	11821		112	10608	
.5	14364	8.6	.5	13061	8.7	.5	11779	8.4	.5	10569	7.8
68	14321		83	13018		98	11737		113	10530	
.5	14278	8.6	.5	12974	8.7	.5	11696	8.3	.5	10491	7.7
69	14235		84	12931		99	11654		114	10453	
.5	14192	8.7	.5	12888	8.7	.5	11613	8.3	.5	10415	7.7
70	14148		85	12844		100	11571		115	10376	
.5	14105	8.7	.5	12801	8.6	.5	11530	8.2	.5	10338	7.6
71	14062		86	12758		101	11489		116	10300	
.5	14019	8.7	.5	12715	8.6	.5	11448	8.2	.5	10262	7.6
72	13975		87	12672		102	11407		117	10224	
.5	13932	8.7	.5	12629	8.6	.5	11366	8.2	.5	10187	7.5
73	13888		88	12585		103	11325		118	10149	
.5	13845	8.7	.5	12542	8.6	.5	11284	8.2	.5	10112	7.5
74	13801		89	12500		104	11244		119	10074	
.5	13758	8.7	.5	12457	8.6	.5	11203	8.1	.5	10037	7.4
75	13714		90	12414		105	11163		120	10000	

ALLOWABLE UNIT STRESSES IN POUNDS PER SQUARE INCH
by Compression Formula of
American Institute of Steel Construction: $f = \dfrac{18{,}000}{1 + \dfrac{1}{18{,}000}(l/r)^2}$

SECONDARY MEMBERS—Ratios of l/r up to 200

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
120	10000		140	8617		160	7431		180	6429	
.5	9963	7.4	.5	8585	6.4	.5	7404	5.4	.5	6406	4.6
121	9926		141	8553		161	7377		181	6383	
.5	9890	7.3	.5	8521	6.3	.5	7350	5.4	.5	6360	4.5
122	9853		142	8490		162	7323		182	6338	
.5	9816	7.3	.5	8458	6.3	.5	7296	5.4	.5	6315	4.5
123	9780		143	8427		163	7269		183	6293	
.5	9744	7.2	.5	8396	6.3	.5	7243	5.3	.5	6270	4.5
124	9708		144	8364		164	7217		184	6248	
.5	9672	7.2	.5	8333	6.2	.5	7190	5.3	.5	6226	4.4
125	9636		145	8302		165	7164		185	6204	
.5	9600	7.1	.5	8272	6.1	.5	7138	5.2	.5	6182	4.4
126	9564		146	8241		166	7112		186	6160	
.5	9529	7.1	.5	8210	6.1	.5	7086	5.2	.5	6139	4.3
127	9493		147	8180		167	7061		187	6117	
.5	9458	7.0	.5	8150	6.1	.5	7035	5.1	.5	6095	4.3
128	9423		148	8119		168	7009		188	6074	
.5	9388	7.0	.5	8089	6.0	.5	6984	5.1	.5	6053	4.3
129	9353		149	8060		169	6959		189	6031	
.5	9318	6.9	.5	8030	6.0	.5	6934	5.0	.5	6010	4.2
130	9284		150	8000		170	6908		190	5989	
.5	9249	6.9	.5	7971	5.9	.5	6883	5.0	.5	5968	4.2
131	9215		151	7941		171	6858		191	5947	
.5	9181	6.8	.5	7912	5.9	.5	6834	4.9	.5	5926	4.2
132	9146		152	7882		172	6809		192	5906	
.5	9112	6.8	.5	7853	5.8	.5	6785	4.9	.5	5885	4.1
133	9078		153	7824		173	6760		193	5864	
.5	9045	6.7	.5	7796	5.8	.5	6736	4.9	.5	5844	4.1
134	9011		154	7767		174	6711		194	5824	
.5	8978	6.7	.5	7738	5.7	.5	6687	4.8	.5	5803	4.0
135	8944		155	7710		175	6663		195	5783	
.5	8911	6.6	.5	7681	5.7	.5	6639	4.8	.5	5763	4.0
136	8878		156	7653		176	6615		196	5743	
.5	8845	6.6	.5	7625	5.6	.5	6592	4.7	.5	5723	3.9
137	8812		157	7597		177	6568		197	5703	
.5	8779	6.5	.5	7569	5.6	.5	6545	4.7	.5	5684	3.9
138	8746		158	7541		178	6521		198	5664	
.5	8714	6.5	.5	7514	5.5	.5	6498	4.7	.5	5643	3.9
139	8681		159	7486		179	6475		199	5624	
.5	8649	6.4	.5	7459	5.5	.5	6452	4.6	.5	5606	3.9
140	8617		160	7431		180	6429		200	5586	

CARNEGIE BEAM SECTIONS

18-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 183 18″x12″			CB 182 18″x8½″			CB 181 18″x7½″			
	100 lbs.	93 lbs.	86 lbs.	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.
6	441	410	379	344	318	296	256	230	225	207
7	441	410	379	344	318	296	256	230	225	207
8	441	410	379	344	318	296	256	230	225	207
9	441	410	379	344	318	296	251	224	218	202
10	441	410	379	344	316	294	240	215	208	193
11	441	410	379	332	306	284	230	205	199	185
12	441	410	379	320	295	273	219	196	189	176
13	441	410	379	308	283	263	209	186	180	168
14	441	410	379	296	272	252	199	177	171	159
15	438	407	375	284	261	242	189	168	162	151
16	428	397	367	272	250	232	180	160	153	143
17	417	388	358	261	240	222	171	151	145	136
18	407	378	349	250	229	212	162	144	137	129
19	396	368	339	239	219	203	154	136	130	122
20	386	358	330	228	210	194	146	129	123	116
21	375	349	321	218	201	186	138	122	117	110
22	365	339	312	209	192	177	131	116	111	104
23	355	329	304	200	183	170	125	110	105	99
24	345	320	295	191	175	162	118	105	100	94
25	335	311	286	182	167	155	112	99	94	89
26	325	302	278	175	160	148	107	94	90	85
27	316	293	270	167	153	142	102	90	85	80
28	306	284	262	160	147	135	97	85		
29	297	276	254	153	140	130				
30	288	267	246	147	134	124				
31	280	259	239	140	129	119				
32	271	251	231	135	123	114				
33	263	244	224	129	118					
34	255	237	218							
35	248	229	211							
Area, in.^{2}	29.40	27.35	25.29	22.94	21.17	19.69	17.05	15.30	15.00	13.82
I_{1-1}, in.^{4}	1783.4	1648.4	1514.1	1318.8	1208.1	1117.1	960.8	855.1	810.0	768.6
r_{1-1}, in.	7.79	7.76	7.74	7.58	7.55	7.53	7.51	7.48	7.35	7.46
I_{2-2}, in.^{4}	253.4	234.0	214.7	90.9	82.9	76.4	49.0	43.3	40.5	38.7
r_{2-2}, in.	2.94	2.93	2.91	1.99	1.98	1.97	1.70	1.68	1.64	1.67
Weight Lbs. per Foot	100	93	86	78	72	67	58	52	51	47

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

16-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 165 16″x14″			CB 164 16″x12″			CB 163 16″x8½″			CB 162 16″x7″				CB 161 16″x6″	
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs	63 lbs.	58 lbs.	50 lbs.	45 lbs.	43 lbs.	40 lbs.	38 lbs.	35 lbs.
6	507	472	441	397	366	335	300	278	256	221	198	190	176	168	154
7	507	472	441	397	366	335	300	278	256	221	198	190	176	164	150
8	507	472	441	397	366	335	300	278	256	221	198	186	176	155	142
9	507	472	441	397	366	335	300	278	256	212	190	177	168	146	134
10	507	472	441	397	366	335	300	278	256	202	181	169	161	137	126
11	507	472	441	397	366	335	291	269	247	193	173	160	153	129	118
12	507	472	441	397	366	335	281	259	238	183	164	151	145	120	110
13	507	472	441	397	366	335	270	250	230	174	156	143	138	112	103
14	507	472	441	397	366	335	260	240	221	165	148	135	131	105	96
15	507	472	441	395	364	332	250	231	212	156	140	127	124	98	90
16	507	472	441	386	355	324	240	221	203	148	132	120	117	92	84
17	507	472	441	376	347	316	230	212	195	140	125	113	110	86	78
18	505	469	438	367	338	308	220	203	186	132	118	107	104	80	73
19	495	460	430	358	329	300	211	194	178	125	112	100	99	75	68
20	485	451	421	348	321	292	202	186	171	118	106	95	93	70	64
21	476	442	413	339	312	284	193	178	163	112	100	89	88	66	60
22	466	433	404	330	303	277	185	170	156	106	95	84	84		
23	456	423	395	320	295	269	177	163	149	101	90	80	79		
24	446	414	386	311	287	261	169	156	143	95	85	75	75		
25	436	405	378	302	278	253	162	149	136	90	81	71	71		
26	426	396	369	294	270	246	155	143	131	86	77				
27	416	386	361	285	262	239	148	136	125						
28	406	377	352	277	255	232	142	131	120						
29	397	368	344	269	247	225	136	125	114						
30	387	360	336	261	240	218	130	120	110						
31	378	351	327	253	233	211	125	115	105						
32	369	342	319	245	226	205	120	110	101						
33	360	334	312	238	219	199	115	106	97						
34	351	326	304	231	212	193									
35	342	318	296	224	206	187									
Area, in.²	33.82	31.46	29.41	26.46	24.41	22.34	20.00	18.52	17.06	14.70	13.23	12.65	11.75	11.17	10.29
I_{1-1}, in⁴	1665.6	1537.2	1426.8	1275.5	1167.7	1061.3	923.7	849.9	776.6	666.0	595.0	523.8	524.6	475.1	435.5
r_{1-1}, in.	7.02	6.99	6.97	6.94	6.92	6.89	6.80	6.77	6.75	6.73	6.71	6.44	6.68	6.52	6.50
I_{2-2}, in.⁴	426.2	393.9	366.0	230.0	210.4	191.1	81.3	74.6	68.0	38.2	34.0	28.9	29.8	19.2	17.5
r_{2-2}, in.	3.55	3.54	3.53	2.95	2.94	2.92	2.02	2.01	2.00	1.61	1.60	1.51	1.59	1.31	1.30
Weight Lbs. per Foot	115	107	100	90	83	76	68	63	58	50	45	43	40	38	35

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 146 14″x15″									
	305 lbs.	295 lbs.	285 lbs.	275 lbs.	265 lbs.	255 lbs.	245 lbs.	235 lbs.	225 lbs.	215 lbs.
11	1346	1301	1257	1213	1169	1125	1081	1037	993	949
12	1346	1301	1257	1213	1169	1125	1081	1037	993	949
13	1346	1301	1257	1213	1169	1125	1081	1037	993	949
14	1346	1301	1257	1213	1169	1125	1081	1037	993	949
15	1346	1301	1257	1213	1169	1125	1081	1037	993	949
16	1346	1301	1257	1213	1169	1125	1081	1037	993	949
17	1346	1301	1257	1213	1169	1125	1081	1037	993	949
18	1346	1301	1257	1213	1169	1125	1081	1037	993	949
19	1346	1301	1257	1213	1169	1125	1081	1037	993	949
20	1346	1301	1257	1213	1169	1125	1081	1037	993	949
21	1339	1294	1249	1203	1158	1114	1069	1024	979	935
22	1317	1273	1229	1183	1139	1095	1051	1006	963	919
23	1295	1251	1208	1163	1120	1076	1033	989	946	902
24	1272	1229	1187	1143	1100	1057	1014	971	929	886
25	1250	1208	1165	1122	1080	1038	996	953	912	870
26	1227	1186	1144	1101	1060	1019	977	936	895	853
27	1205	1164	1123	1081	1040	1000	959	918	878	837
28	1182	1142	1102	1060	1020	980	940	900	860	821
29	1159	1120	1080	1040	1000	961	922	882	843	804
30	1137	1098	1059	1019	981	942	903	864	826	788
31	1115	1077	1038	999	961	923	885	847	810	772
32	1092	1055	1018	979	942	905	867	830	793	756
33	1070	1034	997	959	922	886	849	812	777	740
34	1049	1013	977	939	903	868	832	795	760	725
35	1027	992	957	920	885	850	814	779	744	709
36	1006	971	937	900	866	832	797	762	728	694
37	985	951	917	881	848	814	780	746	713	679
38	965	931	898	863	830	797	763	730	697	664
39	944	911	879	844	812	780	747	714	682	650
40	924	892	860	826	795	763	731	699	668	636
Area, in.^{2}	89.70	86.76	83.82	80.87	77.93	74.99	72.06	69.11	66.17	63.23
I_{1-1}, in.^{4}	4121.5	3948.1	3778.1	3607.8	3442.4	3280.0	3119.6	2961.9	2806.2	2654.7
r_{1-1}, in.	6.78	6.75	6.71	6.68	6.65	6.61	6.58	6.55	6.51	6.48
I_{2-2}, in.^{4}	1539.1	1479.4	1420.7	1362.0	1304.2	1247.1	1190.6	1134.5	1079.1	1024.5
r_{2-2}, in.	4.14	4.13	4.12	4.10	4.09	4.08	4.06	4.05	4.04	4.03
Weight Lbs. per Foot	305	295	285	275	265	255	245	235	225	215

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot										
	CB 146 14″x15″										
	205 lbs.	195 lbs.	185 lbs.	175 lbs.	165 lbs.	155 lbs.	145 lbs.	135 lbs.	131 lbs.	125 lbs.	115 lbs.
11	904	860	816	772	728	684	640	596	578	551	507
12	904	860	816	772	728	684	640	596	578	551	507
13	904	860	816	772	728	684	640	596	578	551	507
14	904	860	816	772	728	684	640	596	578	551	507
15	904	860	816	772	728	684	640	596	578	551	507
16	904	860	816	772	728	684	640	596	578	551	507
17	904	860	816	772	728	684	640	596	578	551	507
18	904	860	816	772	728	684	640	596	578	551	507
19	904	860	816	772	728	684	640	596	576	551	507
20	904	860	815	770	725	680	636	591	566	547	502
21	890	846	801	757	713	668	625	581	555	537	494
22	874	831	787	744	700	657	614	570	545	527	485
23	859	816	773	730	688	645	602	560	534	518	476
24	843	801	759	717	675	633	591	549	524	508	467
25	828	786	745	703	662	621	580	539	513	498	458
26	812	771	731	690	649	608	568	528	502	488	448
27	796	756	716	676	637	596	557	518	492	478	439
28	781	741	702	663	624	584	546	507	481	468	430
29	765	727	688	649	611	572	535	497	471	459	421
30	749	712	674	636	599	560	523	486	460	449	413
31	734	697	660	623	586	549	512	476	450	439	404
32	719	683	646	610	574	537	502	466	440	430	395
33	704	668	632	597	561	526	491	456	430	421	386
34	689	654	619	584	549	514	480	446	420	411	378
35	674	640	606	571	538	503	470	436	410	402	369
36	660	626	593	559	526	492	459	426	401	393	361
37	645	613	580	547	514	481	449	417	392	385	353
38	631	599	567	535	503	470	439	407	382	376	345
39	618	586	554	523	492	460	429	398	374	368	337
40	604	573	542	511	481	450	420	389	365	359	330
Area, in.^{2}	60.28	57.34	54.41	51.47	48.52	45.58	42.64	39.70	38.52	36.75	33.82
I_{1-1}, in.^{4}	2505.0	2358.2	2213.5	2071.7	1932.6	1796.8	1662.7	1530.4	1358.4	1402.1	1275.9
r_{1-1}, in.	6.45	6.41	6.38	6.34	6.31	6.28	6.24	6.21	5.94	6.18	6.14
I_{2-2}, in.^{4}	970.3	916.8	863.9	811.6	759.9	709.0	658.5	608.4	547.3	559.4	510.9
r_{2-2}, in.	4.01	4.00	3.98	3.97	3.96	3.94	3.93	3.92	3.77	3.90	3.89
Weight Lbs. per Foot	205	195	185	175	165	155	145	135	131	125	115

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 145 14″x12″			CB 144 14″x10″			CB 143 14″x8″			CB 142 14″x6¾″					CB 141 14″x6″
	105 lbs.	95 lbs.	85 lbs.	75 lbs.	68 lbs.	61 lbs.	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.
6	463	419	375	331	300	269	256	234	212	185	172	168	159	146	132
7	463	419	375	331	300	269	256	234	212	185	172	168	159	146	130
8	463	419	375	331	300	269	256	234	212	184	171	163	157	144	123
9	463	419	375	331	300	269	256	234	212	176	163	155	150	137	116
10	463	419	375	331	300	269	252	230	208	167	155	147	143	131	109
11	463	419	375	331	300	269	243	222	200	159	148	139	136	124	103
12	463	419	375	331	300	269	234	213	193	151	140	131	129	118	96
13	463	419	375	325	294	263	225	205	185	143	133	124	122	111	90
14	463	419	375	316	286	256	215	196	177	135	126	117	115	105	84
15	463	419	375	306	277	248	206	188	170	128	119	110	109	99	79
16	457	413	369	297	269	240	197	180	162	121	112	103	103	94	74
17	447	403	360	288	260	233	189	172	155	114	106	97	97	88	69
18	437	394	352	279	252	225	180	164	148	108	100	91	92	84	64
19	426	384	343	269	244	217	172	157	141	102	94	86	86	79	60
20	416	375	335	260	235	210	164	149	135	96	89	81	82	74	57
21	405	365	326	251	227	203	157	143	129	91	84	76	77	70	53
22	395	356	318	243	219	196	150	136	123	86	80	72	73	66	50
23	384	346	309	234	212	189	143	130	117	81	75	68	69	63	
24	374	337	301	226	204	182	136	124	112	77	71	64	65	59	
25	364	328	293	218	197	175	130	118	107	73	68		62	56	
26	354	319	284	210	190	169	124	113	102	69	64				
27	344	310	276	203	183	163	119	108	97						
28	335	301	269	196	177	157	114	103	93						
29	325	293	261	189	170	152	109	99	89						
30	316	284	254	182	164	146	104	94	85						
31	307	276	246	176	158	141	99	90	81						
32	298	268	239	169	153	136	95								
33	290	260	232	163	147	131									
34	281	253	226	158	142	126									
35	273	246	219	152	137	122									
Area, in.²	30.88	27.93	24.99	22.05	19.99	17.94	17.05	15.59	14.12	12.35	11.47	11.18	10.58	9.71	8.82
I_{1-1}, in.⁴	1169.6	1044.0	921.3	823.5	738.8	656.2	609.4	552.5	496.0	431.5	398.3	357.5	365.6	333.4	292.0
r_{1-1}, in.	6.15	6.11	6.07	6.11	6.08	6.05	5.98	5.95	5.93	5.91	5.89	5.66	5.88	5.86	5.75
I_{2-2}, in.⁴	292.6	262.0	232.0	134.5	120.6	107.1	62.8	56.8	50.8	30.2	27.7	24.2	25.4	23.0	15.5
r_{2-2}, in.	3.08	3.06	3.05	2.47	2.46	2.44	1.92	1.91	1.90	1.56	1.56	1.47	1.55	1.54	1.33
Weight Lbs. per Foot	105	95	85	75	68	61	58	53	48	42	39	38	36	33	30

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 127 12"x14"					CB 126 12"x14"				CB 125 12"x12"			
	230 lbs.	220 lbs.	210 lbs.	200 lbs.	190 lbs.	180 lbs.	170 lbs.	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.
11	1015	971	926	882	838	794	750	706	662	618	574	529	485
12	1015	971	926	882	838	794	750	706	662	618	574	529	485
13	1015	971	926	882	838	794	750	706	662	618	574	529	485
14	1015	971	926	882	838	794	750	706	662	618	574	529	485
15	1015	971	926	882	838	794	750	706	662	618	574	529	485
16	1015	971	926	882	838	794	750	706	662	605	563	521	480
17	1015	971	926	882	838	794	750	706	662	591	550	509	469
18	1015	971	926	882	838	794	750	706	662	576	537	497	458
19	1009	964	920	875	831	782	740	698	655	562	524	485	448
20	991	947	903	859	816	768	726	684	643	548	510	473	437
21	972	929	886	843	801	753	712	671	631	533	497	461	426
22	954	911	869	826	785	737	697	658	618	519	484	449	415
23	935	893	851	810	769	722	683	645	606	505	471	437	404
24	916	875	834	793	754	707	669	631	593	491	458	426	393
25	897	857	817	777	738	692	654	618	581	478	446	414	383
26	878	839	799	760	722	677	640	604	568	464	433	403	373
27	859	821	782	744	706	662	626	591	556	451	421	391	362
28	841	803	765	727	691	647	612	578	544	438	409	380	352
29	822	785	748	711	676	632	598	565	532	425	397	370	342
30	804	767	731	695	660	617	584	552	519	413	386	359	333
31	786	750	715	679	645	603	571	539	508	401	375	349	323
32	768	733	698	664	631	589	557	527	496	389	364	339	314
33	750	716	682	648	616	575	544	514	484	378	353	329	305
34	733	700	666	633	602	561	531	502	473	367	343	319	297
35	716	683	651	618	588	548	519	490	462	356	333	310	288
36	699	667	636	604	574	535	506	479	451	346	323	301	280
37	683	652	621	590	560	522	494	467	440	336	314	293	272
38	667	636	606	576	547	509	482	456	430	326	305	284	264
39	651	621	592	562	534	497	470	445	419	316	296	276	257
40	636	607	578	549	521	485	459	434	409	307	287	268	250
Area, in.^{2}	67.64	64.70	61.76	58.82	55.88	52.94	50.00	47.06	44.12	41.18	38.24	35.28	32.34
I_{1-1}, in.^{4}	1461.9	1426.6	1391.3	1356.1	1320.8	1218.1	1182.8	1147.5	1112.2	934.8	899.5	864.1	828.8
r_{1-1}, in.	4.65	4.70	4.75	4.80	4.86	4.80	4.86	4.94	5.02	4.76	4.85	4.95	5.06
I_{2-2}, in.^{4}	945.5	898.2	852.9	809.5	767.8	702.4	666.9	633.0	600.4	372.4	350.5	329.6	309.9
r_{2-2}, in.	3.74	3.73	3.72	3.71	3.71	3.64	3.65	3.67	3.69	3.01	3.03	3.06	3.10
Weight Lbs. per Foot	230	220	210	200	190	180	170	160	150	140	130	120	110

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot											
	CB 124 12″x10″				CB 123 12″x8″			CB 122 12″x6½″				CB 121 12″x6″
	100 lbs.	91 lbs.	83 lbs.	75 lbs.	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.
6	441	401	366	331	220	198	176	159	150	141	123	110
7	441	401	366	331	220	198	176	159	150	141	123	109
8	441	401	366	331	220	198	176	157	145	139	121	104
9	441	401	366	331	220	198	176	150	137	133	116	98
10	441	401	366	331	220	197	175	143	130	127	110	93
11	441	401	366	331	212	191	169	136	123	120	105	87
12	441	401	366	331	204	184	163	129	116	114	99	82
13	428	391	359	327	197	177	156	122	109	108	94	77
14	415	379	348	318	189	170	150	115	103	102	89	72
15	403	368	338	309	181	163	144	109	97	96	84	67
16	390	356	328	300	174	156	138	103	91	91	79	63
17	377	345	317	290	166	149	132	97	86	86	74	59
18	364	333	307	281	159	143	125	92	81	81	70	55
19	352	322	297	272	152	137	121	87	76	76	66	52
20	339	311	287	263	146	131	115	82	71	72	63	49
21	327	300	277	254	139	125	110	77	67	68	59	46
22	316	289	267	246	133	119	105	73	63	64	56	43
23	304	279	258	237	127	114	100	69	60	61	53	
24	293	269	249	229	122	109	96	65	56	57	50	
25	282	259	240	221	116	104	92	62		54	47	
26	272	249	231	214	111	99	88					
27	262	240	223	206	106	95	84					
28	252	232	215	199	102	91	80					
29	243	223	207	192	97	87	77					
30	234	215	200	185	93	83	73					
31	226	207	193	179	89	80	70					
32	217	200	186	173	86	77	67					
33	210	193	179	167	82							
34	202	186	173	161								
35	195	179	167	155								
Area, in.²	29.41	26.76	24.41	22.05	14.69	13.23	11.76	10.59	9.99	9.40	8.22	7.34
I_{1-1}, in.⁴	659.0	627.2	598.9	570.7	400.5	356.9	313.7	280.1	238.1	246.3	213.4	183.0
r_{1-1}, in.	4.73	4.84	4.95	5.09	5.22	5.19	5.17	5.14	4.88	5.12	5.10	4.99
I_{2-2}, in.⁴	167.5	155.9	147.0	138.5	57.5	51.2	44.9	25.4	21.0	22.3	19.2	13.8
r_{2-2}, in.	2.39	2.41	2.45	2.51	1.98	1.97	1.95	1.55	1.45	1.54	1.53	1.37
Weight Lbs. per Foot	100	91	83	75	50	45	40	36	34	32	28	25

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

10-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 105 10″x12″						CB 104 10″x10″				CB 103 10″x9″		
	140 lbs.	132 lbs.	124 lbs.	116 lbs.	108 lbs.	100 lbs.	92 lbs.	84 lbs.	77 lbs.	70 lbs.	63 lbs.	56 lbs.	49 lbs.
10											278		
11	618	582	547	512	476	441	406	371	340	309	275	247	216
12	618	582	547	512	476	441	406	371	340	309	267	239	212
13	618	582	547	512	476	441	400	364	336	307	258	232	205
14	618	582	547	512	476	441	389	354	326	299	248	224	199
15	618	582	547	512	476	441	378	344	317	290	239	216	192
16	609	575	540	507	473	439	367	334	308	282	230	208	186
17	596	562	528	496	463	430	356	323	298	273	222	201	179
18	582	549	516	484	452	420	344	313	289	265	213	193	173
19	568	536	504	473	442	410	333	303	280	257	205	186	166
20	554	523	492	461	431	401	322	292	270	248	196	178	160
21	540	510	479	450	420	391	311	283	261	240	188	171	154
22	526	497	467	438	410	381	301	273	253	232	181	165	148
23	512	484	455	427	399	372	290	263	244	225	173	158	142
24	499	472	443	416	389	362	280	254	235	217	166	152	137
25	485	458	431	405	378	353	271	245	227	210	159	146	132
26	472	446	419	394	368	343	261	237	219	202	153	140	127
27	459	434	407	383	358	334	252	228	212	195	147	134	122
28	446	422	396	372	349	325	243	220	204	189	141	129	117
29	434	410	385	362	339	316	235	212	197	182	135	124	112
30	421	398	374	352	330	307	226	205	190	176	130	119	108
31	409	387	364	342	320	299	218	198	184	170	125	115	104
32	398	376	353	332	311	291	211	191	177	164	120	110	100
33	386	365	343	323	303	283	203	184	171	158	115	106	96
34	375	355	333	314	294	275	196	178	165	153	110	102	93
35	364	345	324	305	286	267	190	171	160	148	106	98	89
36	354	335	315	296	278	260	183	166	154	143		94	86
37	344	325	306	288	270	252	177	160	149	138			83
38	334	316	297	280	262	245	171	154	144	133			
39	325	307	289	272	255	239	165	149	139	129			
40	315	298	280	264	248	232	160	144	134	125			
Area, in.^{2}	41.17	38.81	36.46	34.11	31.76	29.40	27.06	24.70	22.65	20.59	18.53	16.47	14.41
I_{1-1}, in.^{4}	623.2	603.5	583.9	564.3	544.8	525.1	423.2	403.6	386.5	369.3	300.4	283.2	266.0
r_{1-1}, in.	3.89	3.94	4.00	4.07	4.14	4.23	3.96	4.04	4.13	4.24	4.03	4.15	4.30
I_{2-2}, in.^{4}	391.4	369.6	349.0	329.4	310.7	292.8	163.1	152.0	142.9	134.3	85.2	79.5	74.2
r_{2-2}, in.	3.08	3.09	3.09	3.11	3.13	3.16	2.50	2.48	2.51	2.55	2.14	2.20	2.27
Weight Lbs. per Foot	140	132	124	116	108	100	92	84	77	70	63	56	49

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Continued

10 and 9-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 102 10″x8″			CB 101 10″x6″				CB 93 9″x9″			CB 92 9″x6½″		
	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs.	48 lbs.	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.
6	185	159	137	132	115	101	93	212	190	168	154	141	128
7	185	159	137	132	115	101	92	212	190	168	154	141	128
8	185	159	137	128	110	97	88	212	190	168	154	141	128
9	183	159	137	121	104	92	83	212	190	168	148	135	122
10	175	153	134	115	99	87	79	212	190	168	142	129	117
11	168	147	129	109	93	83	74	212	190	168	135	123	111
12	161	140	124	103	88	78	70	208	186	164	128	117	105
13	153	134	119	97	83	73	65	202	181	159	122	111	100
14	146	128	114	91	78	69	61	196	175	154	115	105	95
15	139	122	109	86	73	65	57	189	169	149	109	99	90
16	132	117	104	80	69	61	54	183	163	144	103	94	85
17	125	111	100	76	65	57	51	176	157	138	98	89	80
18	119	106	95	71	61	54	47	170	152	133	93	84	76
19	113	101	91	69	57	50	45	164	146	128	88	80	72
20	107	96	86	63	54	47	42	158	141	124	83	75	68
21	102	91	83	59	50	45	39	152	135	119	78	71	64
22	97	87	79	56	48	42	37	146	130	114	74	67	61
23	92	83	75	53	45	40	35	141	125	110	70	64	57
24	88	79	72	50	42			135	120	106	67	60	54
25	83	75	68					130	116	102	63	57	52
26	79	71	65					125	111	95	60	54	49
27	75	68	62					120	107	94			
28	72	65	60					116	103	90			
29		62	57					111	99	87			
30		59	54					107	95	83			
31			52					103	92	80			
32								99	88	77			
33								95	85	74			
34								92	82	72			
35								89	79	69			
Area, in.²	12.35	10.58	9.11	8.82	7.64	6.76	6.17	14.11	12.65	11.17	10.29	9.40	8.53
I_{1-1}, in.⁴	190.4	175.6	163.4	163.2	139.5	122.2	107.6	221.1	195.5	170.4	155.4	140.5	126.0
r_{1-1}, in.	3.93	4.07	4.23	4.30	4.27	4.25	4.18	3.96	3.93	3.91	3.89	3.87	3.84
I_{2-2}, in.⁴	36.8	34.4	32.5	18.5	15.7	13.7	12.0	73.8	65.4	57.1	26.6	24.0	21.5
r_{2-2}, in.	1.73	1.80	1.89	1.45	1.43	1.43	1.39	2.29	2.28	2.26	1.61	1.60	1.59
Weight Lbs. per Foot	42	36	31	30	26	23	21	48	43	38	35	32	29

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE BEAM SECTIONS—Concluded

8-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot													
	CB 83 8″x8″											CB 82 8″x6½″		
	90 lbs.	84 lbs.	78 lbs.	72 lbs.	66 lbs.	60 lbs.	54 lbs.	48 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.
6	397	371	344	318	291	264	238	212	185	159	137	132	119	106
7	397	371	344	318	291	264	238	212	185	159	137	132	119	106
8	397	371	344	318	291	264	238	212	185	159	137	132	119	106
9	397	371	344	318	291	264	238	212	185	159	137	127	114	102
10	397	371	344	318	291	264	238	212	185	159	137	122	109	97
11	395	368	341	314	287	260	233	207	180	154	132	116	104	93
12	383	356	330	303	277	251	225	200	174	149	127	111	99	88
13	370	344	319	293	268	242	217	192	168	143	123	105	94	84
14	357	332	307	282	258	234	209	185	161	138	118	100	89	79
15	345	320	296	272	249	225	201	178	155	132	113	95	85	75
16	332	308	285	262	239	216	193	171	149	127	109	90	80	71
17	320	296	274	252	230	208	186	164	143	122	104	85	76	67
18	307	285	264	242	221	199	178	158	137	116	100	80	72	64
19	295	274	253	232	212	191	171	151	131	112	96	76	68	60
20	284	263	243	223	203	183	164	145	126	107	91	72	64	57
21	272	252	233	213	195	176	157	139	120	102	87	68	61	54
22	261	242	224	205	187	168	150	133	115	98	84	65	58	51
23	251	232	215	196	179	161	144	127	110	93	80	61	55	48
24	241	223	206	188	172	154	138	122	105	89	77	58	52	46
25	231	214	197	180	164	148	132	117	101	86	73	55	49	43
26	222	205	189	173	158	142	126	112	97	82	70	52	47	41
27	213	197	182	166	151	136	121	107	93	78	67	50	44	
28	204	189	174	159	145	130	116	102	89	75	64			
29	196	181	167	153	139	125	111	98	85	72	61			
30	188	174	160	146	133	120	107	94	81	69	59			
31	181	167	154	141	128	115	102	90	78	66	56			
32	174	160	148	135	123	110	98	87	75	63	54			
33	167	154	142	130	118	106	94	83	72	61	52			
34	161	148	137	125	113	102	90	80	69					
35	155	143	131	120	109									
Area, in.²	26.47	24.71	22.93	21.17	19.40	17.63	15.87	14.10	12.34	10.58	9.10	8.81	7.93	7.06
I_{1-1}, in.⁴	391.2	358.6	326.5	295.9	265.9	237.1	209.2	182.2	156.2	131.3	110.5	107.8	95.9	84.3
r_{1-1}, in.	3.84	3.81	3.77	3.74	3.70	3.67	3.63	3.59	3.56	3.52	3.49	3.50	3.48	3.46
I_{2-2}, in.⁴	124.4	114.5	104.7	95.3	86.1	77.1	68.3	59.7	51.4	43.4	36.7	23.4	20.8	18.3
r_{2-2}, in.	2.17	2.15	2.14	2.12	2.11	2.09	2.07	2.06	2.04	2.02	2.01	1.63	1.62	1.61
Weight l.bs. per Foot	90	84	78	72	66	60	54	48	42	36	31	30	27	24

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

STANDARD MILL SECTIONS

Miscellaneous Small Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—American Institute of Steel Construction—1923

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	B 40 9″x5¼″		B 39 8″x5″		H 4 8″x8″			H 3 A 6″x6″		H 3 6″x6″		H 2 5″x5″	H 1 4″x4″
	25 lbs.	21 lbs.	21 lbs.	18 lbs.	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.
3	110	93	93	79	165	150	143	121	110	99	88	82	60
4	110	93	93	79	165	150	143	121	110	99	88	82	60
5	110	93	93	79	165	150	143	121	110	99	88	82	59
6	106	91	87	76	165	150	143	121	110	99	88	82	54
7	99	85	81	71	165	150	143	121	110	98	88	77	50
8	92	80	75	66	165	150	143	116	106	93	83	73	46
9	85	74	69	61	165	150	143	110	100	88	79	68	42
10	79	69	63	56	160	146	140	104	95	83	75	63	38
11	73	64	58	52	154	141	135	98	90	78	70	59	35
12	67	59	53	47	147	135	130	92	84	73	66	55	32
13	62	54	49	44	141	130	124	87	79	69	62	51	29
14	57	50	45	40	135	124	119	81	75	64	58	47	26
15	53	45	41	37	129	119	114	76	70	60	55	44	24
16	49	43	38	34	123	114	109	72	66	56	51	41	
17	45	40	35	32	117	108	104	67	62	53	48	38	
18	42	37			112	103	100	63	58	50	45	35	
19		34			106	99	95	59	55	46	42	33	
20					101	94	91	56	51	44	40	31	
21					96	90	86	52	48	41	37		
22					92	85	83	49	46	38	35		
23					87	81	79	46	43		33		
24					83	78	75						
25					79	74	72						
26					76	71	68						
27					72	67	65						
28					69	64	62						
29					66	62	60						
30					63	59	57						
Area, in.^{2}	7.34	6.17	6.17	5.29	11.00	10.00	9.50	8.08	7.33	6.61	5.86	5.47	3.99
$I_{1\text{-}1}$, in.^{4}	95.5	87.6	63.4	58.7	120.8	115.5	112.8	49.3	47.0	41.0	38.8	23.8	10.7
$r_{1\text{-}1}$, in.	3.61	3.77	3.21	3.33	3.31	3.40	3.45	2.47	2.53	2.49	2.57	2.08	1.64
$I_{2\text{-}2}$, in.^{4}	8.8	8.1	6.6	6.1	36.9	35.1	34.2	16.0	14.9	12.2	11.4	7.8	3.6
$r_{2\text{-}2}$, in.	1.09	1.14	1.03	1.07	1.83	1.87	1.90	1.41	1.43	1.36	1.39	1.20	0.95
Weight Lbs. per Foot	25	21	21	18	37.7	34.3	32.6	27.5	25	22.5	20	18.9	13.8

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

CARNEGIE
BEAM SECTIONS

BEAM AND COLUMN
SAFE LOADS

in accordance with Building Codes of

THE CITY OF NEW YORK

as amended to January 1, 1926

and

THE CITY OF CHICAGO

as amended to July 1, 1924

SAFE LOADS FOR SECTIONS USED AS BEAMS

EXPLANATION OF TABLES

Tables of safe loads for Carnegie Beam Sections used as beams under conditions of static transverse loading, give the uniformly distributed safe loads in thousands of pounds for spans customary in bridge and building construction, based upon an extreme fiber stress of 16,000 pounds per square inch. These tables give the full loads for beams fixed or braced against lateral deflection as well as the reduced loads allowed for beams free or unbraced against side deflection, and also the values for those spans at which the allowed safe load will produce a deflection of $\frac{1}{360}$ of the span length. The loads in all cases include the weight of the section, which should be deducted in order to arrive at the net load which the section will support.

It is assumed in all cases that the loads are applied normal to the axis 1-1 as shown in the tables of elements of sections, and that the beam deflects vertically in the plane of bending only. If the conditions of loading involve the introduction of forces outside this plane of loading, the allowable safe loads must be determined from the general theory of flexure, in accordance with the mode of application of the load and its character. In cases of eccentric loading, the actual safe loads would be considerably lower than the tabulated safe loads which have been based upon the most favorable conditions of loading.

Vertical Deflection. The vertical deflection of a section under a uniformly distributed load is determined from formula:

Deflection, $D=\frac{5}{384}\frac{Wl^3}{EI}$; $\quad Wl=8\,f\,\frac{I}{n}$

" $D=\frac{40}{384}\frac{fl^2}{En}$; $\quad$ Span length in feet: $l=12L$

" $D=\frac{15\,fL^2}{En}$ inches

Steel, E=29,000,000; for fiber stress f=16,000 pounds:

$$\text{Deflection, } D=\frac{0.01655L^2}{2n}$$

n=distance from center line of gravity to extreme fiber:

$$\text{Deflection}=\frac{\text{Coefficient}}{2n}$$

Deflection Coefficients for Fiber Stress of 16,000 Pounds

Span, Feet	Coefficient 16,000	Span, Feet	Coefficient 16,000	Span, Feet	Coefficient 16,000	Span, Feet	Coefficient 16,000
1	0.017	16	4.237	31	15.906	46	35.023
2	0.066	17	4.783	32	16.949	47	36.563
3	0.149	18	5.363	33	18.025	48	38.135
4	0.265	19	5.975	34	19.134	49	39.741
5	0.414	20	6.621	35	20.276	50	41.379
6	0 596	21	7.299	36	21.451	51	43.051
7	0.811	22	8.011	37	22.659	52	44.756
8	1.059	23	8.756	38	23.901	53	46.494
9	1.341	24	9.534	39	25.175	54	48.265
10	1.655	25	10.345	40	26.483	55	50.069
11	2.003	26	11.189	41	27.823	56	51.906
12	2.383	27	12.066	42	29.197	57	53.777
13	2.797	28	12.977	43	30.604	58	55.680
14	3.244	29	13.920	44	32.044	59	57.617
15	3.724	30	14.897	45	33.517	60	59.586

The deflection, in inches, of sections subjected to transverse stresses due to uniformly distributed loads are obtained as follows:

Symmetrical Sections. To find the deflection in inches of a section symmetrical about the neutral axis, such as I- and H-beams, divide the coefficient in the table corresponding to given span and fiber stress by the depth of the section in inches.

Unsymmetrical Sections. To find the deflection in inches of a section not symmetrical about the neutral axis, such as beams with unbalanced flange plates or with continuous shelf angles, divide the coefficient corresponding to given span and fiber stress by twice the distance of extreme fiber from neutral axis obtained by computation.

Other Fiber Stresses. To find the deflection of any section for other fiber stresses than those given, multiply the coefficient for 16,000 pounds fiber stress corresponding to the span given by the ratio of desired fiber stress and 16,000.

Limits of Deflection. The deflection of floor beams carrying plastered ceilings should be limited to not more than $\frac{1}{360}$ of the span length; this limit is indicated in the safe load tables by lower zigzag line, is derived from the following formulas:

$$\text{Deflection, } D_{max.} = \frac{12L}{360} = \frac{15fL^2}{En} \qquad \text{Limiting Span, } L_{max.} = \frac{En}{450f}$$

for fiber stress of 16,000, Limiting Span, $L_{max.} = 4.027n$

Lateral Deflection of Beams. In computing safe loads it is generally assumed that the compression flanges of the sections are secured against lateral deflection by the use of tie rods or by other means.

When lateral bracing is not provided and the unbraced span length is excessive, the full safe loads must be reduced in accordance with the ratios given in the following table in order to insure that the stresses in the compression flanges do not exceed the safe unit stress. The lateral unbraced length of beams and girders should not exceed forty times the width of the compression flanges.

The following table gives values obtained from formulas for:

New York Building Code $f_c = 21{,}000\text{-}250\ l/b$, interpretation of $f_c = 16{,}000\text{-}70\ l/r$, $r = b/\sqrt{12}$ (approximate value: $r = 0.28b$). Full stress of 16,000 pounds is used up to values of $l/b = 20$.

Chicago Building Code $f_c = 20{,}000\text{-}160\ l/b$. Full stress of 16,000 pounds is used up to values of $l/b = 25$.

Reduction of Safe Loads for Ratio of Span Length to Flange Width, l/b.

Ratio, l/b	Full Load, Per Cent.		Ratio, l/b	Full Load, Per Cent.		Ratio, l/b	Full Load, Per Cent.		Ratio, l/b	Full Load, Per Cent.	
	New York	Chicago		New York	Chicago		New York	Chicago		New York	Chicago
20	100	100	25	92.2	100	30	84.4	95.0	35	76.6	90.0
20.5	99.2	100	25.5	91.4	99.5	30.5	83.6	94.5	35.5	75.8	89.5
21	98.4	100	26	90.6	99.0	31	82.8	94.0	36	75.0	89.0
21.5	97.7	100	26.5	89.8	98.5	31.5	82.0	93.5	36.5	74.2	88.5
22	96.9	100	27	89.1	98.0	32	81.3	93.0	37	73.4	88.0
22.5	96.1	100	27.5	88.3	97.5	32.5	80.5	92.5	37.5	72.7	87.5
23	95.3	100	28	87.5	97.0	33	79.7	92.0	38	71.9	87.0
23.5	94.5	100	28.5	86.7	96.5	33.5	78.9	91.5	38.5	71.1	86.5
24	93.8	100	29	85.9	96.0	34	78.1	91.0	39	70.3	86.0
24.5	93.0	100	29.5	85.2	95.5	34.5	77.3	90.5	39.5	69.5	85.5
									40	68.8	85.0

In addition to this lateral deflection which is induced within the beam by the action of vertical loading, lateral deflection may be induced by the thrust of floor arches or other loading acting on an axis perpendicular to the line of principal bending stress.

Stresses due to horizontal thrust should either be neutralized by tie rods, or the safe carrying capacity of the beam should be computed in accordance with the general formulas of flexure to provide for the combined stresses due to the action of both vertical and horizontal forces; that is to say, the safe loads should be figured around both the axes 1-1 and 2-2, and the unit stress computed so as not to exceed the allowable fiber stress.

Effect of Impact on Stresses. The formulas upon which the tables of safe loads are based assume all loads to be quiescent or static. The effect of moving loads may be taken care of either by reducing the allowable unit stresses, or else by increasing the theoretical loads.

When a load is suddenly applied, the resultant stresses are twice as great as those due to an equal quiescent load.

When an instantaneously applied load produces impact or percussion, the resultant stresses are dynamic and are measured by the laws governing the energy of bodies in motion. The following formulas give the fiber stress and deflection due to a load falling on center of a beam rigidly supported at both ends when the weight of beam is negligible as compared with that of falling load, and when no account is taken of the local distortion due to impact or percussion at point of application of load; but when the weight of the beam is a real factor, theoretical formulas do not agree with observed results and practical tests give values which are far less than those indicated by theoretical formulas; this is notably true in drop-tests of axles:

W =Weight of falling load, in pounds.
h =Height of fall, in inches.
f =Extreme fiber stress due to static effect of load, W, in pounds per square inch.
fd =Extreme fiber stress due to impact of load, W, in pounds per square inch.
D =Deflection due to static effect of load, W, in inches.
Dd=Deflection due to impact of load, W, in inches.

$$fd = f\left(1 + \sqrt{\frac{2h}{D} + 1}\right) \qquad Dd = D\left(1 + \sqrt{\frac{2h}{D} + 1}\right)$$

Shearing Stresses. The safe load tables for beams are computed solely with reference to safe unit stresses due to flexure, and the safe loads uniformly distributed on the spans given will not produce excessive shearing stresses in the web.

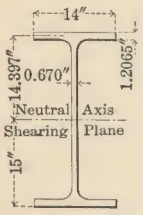
When, however, beams must support heavy loads which are concentrated near the supports, or when beams of short span are loaded with uniformly distributed loads to their full carrying capacity as regards flexure, the bending moments may be small in comparison with the reactions at the supports, and the beams may fail along the neutral plane as a result of longitudinal shearing stresses, or may buckle as a result of the combined longitudinal and vertical web stresses. On such spans the safe shearing or buckling strength of the web may limit the carrying capacity of the beam, so that the deciding factor will often be the resistance of the web to shearing stresses, rather than the resistance of the flanges to bending stresses.

Longitudinal Shear. At any point in any section of a beam, the horizontal and vertical components of the web stress are equal to each other and proportional to the vertical shear; their intensities are dependent upon the distance of the point from the neutral axis. In order to determine the intensity of the vertical shearing stress at a given point in a vertical section of the beam, therefore, it is sufficient to find the equal intensity of the horizontal shearing stress at the same point in the horizontal plane.

The longitudinal unit shear is zero at the upper and lower flanges of the beam and a maximum at the neutral plane. It is greatest at the supports and zero where there is no vertical shear.

The intensity of the longitudinal shear at any point in any section is the product of the vertical shear, V, for that section and the static moment, M_S, of the section included between the horizontal plane of shear through that point and the extreme fibers on the same side of the neutral plane divided by the product of the moment of inertia of the beam around the proper axis and the thickness at the plane of shear; or

$$\text{Longitudinal shear per square inch} = \frac{V\,Ms}{t\,I}.$$



Example—Required the maximum longitudinal unit shear in Carnegie Beam Section CB-302, 30″ x 14″, 180 lb. for a maximum vertical shear of 201,000 pounds.

Ms of Flange = 14 x 1.2065 x 14.397 = 243.2
Ms of Web = 13.794 x 0.67 x 6.897 = 63.7
Total Static Moment 306.9 in.³
Moment of Inertia of Beam, I = 8301.4 in.⁴

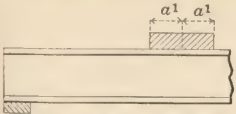
$$\text{Longitudinal Shear} = \frac{201{,}000 \times 306.9}{8301.4 \times 0.67}$$

= 11,090 pounds per square inch.

Under usual conditions of loading, the longitudinal shear need not be taken into consideration.

Buckling Values of Beam Webs. The vertical shearing stresses or the vertical compressive components of the web stress may, under some conditions, exceed the safe resistance of the beam to buckling, and there remains the possibility that a web which is amply secure as against the safe allowed shear will not be of sufficient strength when considered as a column. In such cases provision must be made for security against buckling either by web stiffeners or by increasing the thickness of the web.

Experiments with beams of various depths and web thicknesses have demonstrated that the length of the web which can be assumed to resist buckling stresses is equal to the end bearing plus one fourth of the depth of the beam; the following formulas have been deduced:



Safe end reaction $R = f_b \times t \left(a + \frac{d}{4}\right)$

Safe interior load $W = 2f_b \times t \left(a^1 + \frac{d}{4}\right)$

In the formulas R is the end reaction, W the concentrated load, t the web thickness, d the depth of the beam, a^1 half the distance over which the concentrated load is applied, a the whole distance over which the end reaction is applied, and f_b is the safe unit resistance of the web to buckling.

The first formula is general and applies to any condition of loading. The second formula is for a single load concentrated at the center of a span; it can be extended for a system of concentrated loads, provided the sum of the distances a^1 is not less than a.

For computation of f_b the following formula has been used in the tables, corresponding to an allowable shearing stress of 10,000 pounds, f_b maximum = 15,000 pounds.

$f_c = 19{,}000 - 100\ l/r$, $l = \frac{1}{2}d$ and $r = t/\sqrt{12}$, $f_b = 19{,}000 - 173d/t$

This formula is not part of the building codes of New York or of Chicago, and the values based upon same are given in the tables which follow for general information only.

The tables give for beams with unsupported webs:

1. Allowed web resistance f_b, in pounds per square inch, computed from this compression formula.

2. The distance a, or the distance over which the end reaction must be distributed when the shearing stress, V, in the web is the maximum allowable of 10,000 pounds per square inch.

3. The allowable end reaction (R) when a is taken at $3\frac{1}{2}''$, which is the usual length of beam actually resting on the 4″ angles ordinarily used in building construction for beam seats.

4. The allowable shear V, on the gross area of beam webs at 10,000 pounds per square inch.

Maximum Bending Moments. In addition to data referring to maximum loads on beams as computed from the web resistance, these tables also give the maximum bending moments in foot pounds, which may be used instead of the table of properties, to ascertain the proper size section to be used in any particular instance.

CARNEGIE BEAM SECTIONS

Maximum Bending Moments and Web Resistances

Bending Stress 16,000 Pounds—Shearing Stress 10,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 302 30″	30.781	240	.888	983,850	273,340	14.40	13,003	15.98	129,270
	30.522	220	.816	901,750	249,060	14.48	12,529	16.73	113,800
	30.263	200	.743	820,000	224,850	14.59	11,954	17.75	98,280
	30.000	180	.670	737,850	201,000	14.68	11,254	19.16	82,940
CB 301 30″	30.298	135	.621	519,850	188,150	11.05	10,559	21.12	72,620
	30.148	125	.576	481,350	173,650	11.09	9,945	22.78	63,220
	30.000	115	.530	443,200	159,000	11.15	9,208	25.08	53,680
CB 272 27″	27.598	190	.756	712,800	208,640	13.67	12,685	14.86	99,730
	27.400	175	.698	656,650	191,250	13.73	12,209	15.59	88,200
	27.200	160	.639	600,150	173,810	13.81	11,636	16.58	76,590
	27.000	145	.580	544,150	156,600	13.90	10,947	17.92	65,080
CB 271 27″	27.340	112	.566	390,950	154,740	10.11	10,643	18.85	62,260
	27.166	101	.510	352,950	138,550	10.19	9,785	20.97	51,360
	27.000	91	.461	317,750	124,470	10.21	8,868	23.70	41,900
CB 244 24″	24.664	160	.670	547,750	165,250	13.26	12,632	13.36	81,810
	24.526	150	.629	513,200	154,270	13.31	12,254	13.88	74,240
	24.388	140	.588	478,950	143,400	13.36	11,825	14.53	66,730
	24.250	130	.547	444,800	132,650	13.41	11,330	15.34	59,270
CB 243 24″	24.310	120	.539	402,550	131,030	12.29	11,197	15.63	57,800
	24.156	110	.494	369,050	119,330	12.37	10,541	16.88	49,670
	24.000	100	.450	335,600	108,000	12.43	9,773	18.56	41,780
CB 242 24″	24.308	94	.499	300,000	121,300	9.89	10,573	16.91	50,530
	24.154	85	.452	271,350	109,180	9.94	9,755	18.72	42,060
	24.000	76	.405	242,650	97,200	9.99	8,748	21.43	33,660
CB 241 24″	24.000	70	.400	217,050	96,000	9.04	8,620	21.84	32,760
CB 213 21″	21.248	120	.535	362,800	113,680	12.77	12,129	12.21	57,180
	21.126	112	.499	338,800	105,420	12.86	11,676	12.81	51,160
	21.000	104	.465	314,250	97,650	12.87	11,187	13.52	45,520
CB 212 21″	21.240	92	.502	262,000	106,630	9.83	11,680	12.87	51,660
	21.120	86	.470	244,800	99,260	9.86	11,226	13.53	46,330
	21.000	80	.438	227,850	91,980	9.91	10,705	14.37	41,030
CB 211 21″	21.248	70	.433	193,600	92,000	8.42	10,511	14.90	40,100
	21.126	64	.396	177,200	83,660	8.47	9,771	16.34	33,980
	21.000	58	.360	160,400	75,600	8.49	8,908	18.32	28,060
	21.034	60	.375	165,450	78,880	8.39	9,296	17.37	30,530

CARNEGIE BEAM SECTIONS—Continued

Maximum Bending Moments and Web Resistances

Bending Stress 16,000 Pounds—Shearing Stress 10,000 Pounds

Section Index and Nominal	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 183 18″	18.238	100	.498	260,800	90,830	11.49	12,664	9.84	50,830
	18.120	93	.463	242,550	83,900	11.56	12,229	10.29	45,470
	18.000	86	.429	224,250	77,220	11.62	11,741	10.83	40,300
CB 182 18″	18.242	78	.471	192,800	85,920	8.98	12,300	10.27	46,700
	18.110	72	.436	177,850	78,960	9.01	11,814	10.80	41,350
	18.000	67	.406	165,450	73,080	9.06	11,330	11.39	36,800
CB 181 18″	18.252	58	.393	140,400	71,730	7.83	10,965	12.08	34,750
	18.114	52	.354	125,850	64,120	7.85	10,148	13.32	28,840
	18.000	47	.320	113,850	57,600	7.91	9,269	14.92	23,730
	18.024	51	.375	119,850	67,590	7.09	10,685	12.36	32,080
CB 165 16″	16.236	115	.532	273,600	86,380	12.67	13,720	7.77	55,170
	16.110	107	.496	254,400	79,910	12.74	13,381	8.01	49,960
	16.000	100	.464	237,750	74,240	12.81	13,034	8.28	45,360
CB 164 16″	16.240	90	.495	209,450	80,390	10.42	13,324	8.13	49,860
	16.120	83	.458	193,200	73,830	10.47	12,911	8.46	44,530
	16.000	76	.419	176,950	67,040	10.56	12,394	8.91	38,950
CB 163 16″	16.226	68	.438	151,850	71,070	8.55	12,591	8.83	41,670
	16.114	63	.406	140,650	65,420	8.60	12,134	9.25	37,090
	16.000	58	.375	129,450	60,000	8.63	11,619	9.77	32,680
CB 162 16″	16.254	50	.362	109,200	58,840	7.42	11,232	10.41	30,750
	16.128	45	.326	98,400	52,580	7.49	10,441	11.41	25,640
	16.000	40	.290	87,450	46,400	7.54	9,455	12.92	20,570
	15.934	43	.375	87,600	59,750	5.86	11,649	9.69	32,690
CB 161 16″	16.012	38	.314	79,050	50,280	6.29	10,178	11.73	23,980
	15.930	35	.290	72,950	46,200	6.32	9,497	12.79	20,610
CB 145 14″	14.370	105	.536	217,050	77,020	11.27	14,362	6.41	54,600
	14.186	95	.485	196,250	68,800	11.41	13,940	6.63	47,640
	14.000	85	.435	175,450	60,900	11.53	13,432	6.92	40,900
CB 144 14″	14.382	75	.468	152,650	67,310	9.07	13,684	6.91	45,440
	14.238	68	.425	138,400	60,510	9.15	13,204	7.22	39,620
	14.094	61	.382	124,150	53,840	9.22	12,617	7.65	33,850
CB 143 14″	14.242	58	.413	114,150	58,820	7.76	13,034	7.37	38,010
	14.122	53	.378	104,250	53,380	7.81	12,537	7.73	33,320
	14.000	48	.343	94,550	48,020	7.87	11,939	8.23	28,670

CARNEGIE BEAM SECTIONS—Continued

Maximum Bending Moments and Web Resistances

Bending Stress 16,000 Pounds—Shearing Stress 10,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
	14.240	42	.342	80,800	48,700	6.64	11,797	8.51	28,480
CB 142 14″	14.160	39	.318	75,050	45,030	6.67	11,297	8.99	25,290
	14.080	36	.294	69,200	41,400	6.69	10,715	9.62	22,110
	14.000	33	.270	63,450	37,800	6.72	10,030	10.46	18,960
	14.000	38	.375	68,150	52,500	5.19	12,541	7.66	32,920
CB 141 14″	13.964	30	.270	55,750	37,700	5.91	10,053	10.40	18,980
	12.000	100	1.121	146,400	134,520	4.35	15,000	5.00	109,300
CB 124 12″	12.000	91	.900	139,350	108,000	5.16	15,000	5.00	87,750
	12.000	83	.704	133,050	84,480	6.30	15,000	5.00	68,640
	12.000	75	.508	126,800	60,960	8.32	14,913	5.05	49,240
	12.258	50	.361	87,200	44,250	7.88	13,126	6.27	31,110
CB 123 12″	12.130	45	.326	78,400	39,540	7.93	12,563	6.62	26,750
	12.000	40	.290	69,750	34,800	8.02	11,841	7.13	22,320
	12.236	36	.308	61,050	37,690	6.48	12,127	7.03	24,500
CB 122 12″	12.118	32	.274	54,250	33,200	6.54	11,349	7.65	20,300
	12.000	28	.240	47,450	28,800	6.59	10,350	8.59	16,150
	12.022	34	.375	52,800	45,080	4.69	13,454	5.93	32,820
CB 121 12″	11.924	25	.240	40,950	28,620	5.72	10,405	8.48	16,180
	10.000	63	.787	80,150	78,700	4.07	15,000	4.17	70,830
CB 103 10″	10.000	56	.581	75,450	58,100	5.20	15,000	4.17	52,290
	10.000	49	.375	70,950	37,500	7.57	14,387	4.45	32,370
	10.000	42	.644	50,800	64,400	3.16	15,000	4.17	57,960
CB 102 10″	10.000	36	.467	46,800	46,700	4.01	15,000	4.17	42,030
	10.000	31	.320	43,600	32,000	5.45	13,594	4.86	26,100
	10.228	30	.298	42,550	30,480	5.58	13,062	5.27	23,580
CB 101 10″	10.098	26	.259	36,800	26,150	5.63	12,255	5.72	19,120
	10.000	23	.230	32,550	23,000	5.66	11,478	6.21	15,840
	9.902	21	.230	28,950	22,780	5.08	11,552	6.10	15,880

CARNEGIE BEAM SECTIONS—Concluded

Maximum Bending Moments and Web Resistances

Bending Stress 16,000 Pounds—Shearing Stress 10,000 Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 93 9″	9.242	48	.398	63,750	36,780	6.93	14,983	3.86	34,650
	9.122	43	.357	57,200	32,570	7.03	14,580	3.98	30,090
	9.000	38	.316	50,550	28,440	7.11	14,073	4.15	25,570
CB 92 9″	9.192	35	.335	45,050	30,790	5.85	14,253	4.15	27,680
	9.096	32	.307	41,200	27,930	5.90	13,874	4.28	24,590
	9.000	29	.279	37,350	25,110	5.95	13,419	4.46	21,530
CB 83 8″	8.360	42	.390	49,850	32,600	6.12	15,000	3.48	32,700
	8.198	36	.336	42,650	27,550	6.20	14,779	3.50	27,560
	8.060	31	.290	36,650	23,370	6.27	14,192	3.66	22,700
CB 82 8″	8.196	30	.298	35,050	24,420	5.74	14,242	3.71	23,550
	8.098	27	.268	31,600	21,700	5.82	13,773	3.86	20,390
	8.000	24	.239	28,150	19,120	5.89	13,209	4.06	17,360

STANDARD MILL SECTIONS

B 40 9″	9.000	25	.380	28,250	34,200	3.31	14,903	3.79	32,560
	9.000	21	.250	26,000	22,500	4.62	12,772	4.80	18,360
B 39 8″	8.000	21	.360	21,200	28,800	2.94	15,000	3.33	29,700
	8.000	18	.250	19,600	20,000	3.92	13,464	3.94	18,510
H 4 8″	8.000	37.7	.500	40,250	40,000	4.03	15,000	3.33	41,250
	8.000	34.3	.375	38,550	30,000	5.14	15,000	3.33	30,940
	8.000	32.6	.313	37,600	25,040	6.01	14,578	3.49	25,100
H 3-A 6″	6.000	27.5	.438	21,850	26,280	3.33	15,000	2.50	32,850
	6.000	25.0	.313	20,950	18,780	4.46	15,000	2.50	23,480
H 3 6″	6.000	22.5	.375	18,250	22,500	3.25	15,000	2.50	28,130
	6.000	20.0	.250	17,200	15,000	4.59	14,848	2.54	18,560
H 2 5″	5.000	18.9	.313	12,650	15,650	3.24	15,000	2.08	22,300
H 1 4″	4.000	13.8	.313	7,050	12,520	2.26	15,000	1.67	21,130

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 302 30"x14"								CB 301 30"x10½"						
	240 lbs.		220 lbs.		200 lbs.		180 lbs.		135 lbs.		125 lbs.		115 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									376	376	347	347	318	318	
12									347	347	321	321	295	295	2.383
13									320	320	296	296	273	273	2.797
14	547	547	498	498	450	450	402	402	297	297	275	275	253	253	3.244
15	525	525	481	481	437	437	394	394	277	277	257	257	236	236	3.724
16	492	492	451	451	410	410	369	369	260	260	241	241	222	222	4.237
17	463	463	424	424	386	386	347	347	245	245	227	227	209	209	4.783
18	437	437	401	401	364	364	328	328	231	229	214	212	197	195	5.363
19	414	414	380	380	345	345	311	311	219	214	203	198	187	181	5.975
20	394	394	361	361	328	328	295	295	208	199	193	184	177	170	6.621
21	375	375	343	343	312	312	281	281	198	186	183	172	169	158	7.299
22	358	358	328	328	298	298	268	268	189	174	175	161	161	148	8.011
23	342	342	314	314	285	285	257	257	181	164	167	151	154	139	8.756
24	328	327	301	299	273	271	246	244	173	154	160	142	148	130	9.534
25	315	310	289	283	262	257	236	231	166	145	154	134	142	123	10.345
26	303	293	277	269	252	243	227	219	160	136	148	126	136	116	11.189
27	291	279	267	255	243	232	219	208	154	129	143	119	131	109	12.066
28	281	265	258	243	234	220	211	198	149	121	138	112	127	103	12.977
29	271	252	249	231	226	209	204	188	143	115	133	106	122	97	13.920
30	262	241	240	220	219	200	197	179	139	108	128	100	118	92	14.897
31	254	229	233	210	212	190	190	171	134	103	124	95	114	87	15.906
32	246	219	225	200	205	182	184	163	130	97	120	89	111	82	16.949
33	238	210	219	191	199	173	179	156	126	92	117	85	107	78	18.025
34	231	200	212	183	193	166	174	149	122	87	113	80	104	74	19.134
35	225	191	206	175	187	159	169	142	119	82	110	76	101	70	20.276
36	219	183	200	167	182	152	164	136	116		107		98		21.451
37	213	175	195	160	177	145	160	130	112		104		96		22.659
38	207	168	190	153	173	139	155	125	109		101		93		23.901
39	202	161	185	147	168	133	151	119	107		99		91		25.175
40	197	154	180	141	164	128	148	115	104		96		89		26.483
41	192	148	176	135	160	122	144	110	101		94		86		27.823
42	187	142	172	129	156	118	141	105	99		92		84		29.197
43	183	137	168	125	153	113	137	101	97		90		82		30.604
44	179	131	164	120	149	108	134	97	95		88		81		32.044
45	175	126	160	115	146	104	131	93	92		86		79		33.517
46	171	121	157	110	143	100	128	89	90		84		77		35.023
47	167	116	153	106	140		126		89		82		75		36.563
48	164		150		137		123		87		80		74		38.135
49	161		147		134		120		85		79		72		39.741
50	157		144		131		118		83		77		71		41.279
51	154		141		129		116		82		76		70		43.051
52	151		139		126		114		80		74		68		44.756
53	149		136		124		111		78		73		67		46.494
54	146		134		121		109		77		71		66		48.265
55	143		131		119		107		76		70		64		50.069
56	141		129		117		105		74		69		63		51.906
57	138		127		115		104		73		68		62		53.777
58	136		124		113		102		72		66		61		55.680
59	133		122		111		100		70		65		60		57.617
60	131		120		109		98		69		64		59		59.586
61	129		118		108		97		68		63		58		61.589
62	127		116		106		95		67		62		57		63.625

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	CB 272 27″x14″								CB 271 27″x9¾″						Coefficient of Deflection
	190 lbs.		175 lbs.		160 lbs.		145 lbs.		112 lbs.		101 lbs.		91 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									309	309	277	277	249	249	
11									284	284	257	257	231	231	2.003
12									261	261	235	235	212	212	2.383
13	417	417	383	383	348	348	313	313	241	241	217	217	196	196	2.797
14	407	407	375	375	343	343	311	311	223	223	202	202	182	182	3.244
15	380	380	350	350	320	320	290	290	208	208	188	188	169	169	3.724
16	356	356	328	328	300	300	272	272	195	195	176	176	159	159	4.237
17	335	335	309	309	282	282	256	256	184	182	166	164	150	147	4.783
18	317	317	292	292	267	267	242	242	174	168	157	152	141	136	5.363
19	300	300	276	276	253	253	229	229	165	156	149	141	134	126	5.975
20	285	285	263	263	240	240	218	218	156	146	141	131	127	118	6.621
21	272	272	250	250	229	229	207	207	149	136	134	122	121	110	7.299
22	259	259	239	239	218	218	198	198	142	127	128	114	116	103	8.011
23	248	248	228	228	209	209	189	189	136	119	123	107	111	96	8.756
24	238	237	219	217	200	199	181	180	130	111	118	100	106	90	9.534
25	228	224	210	206	192	188	174	170	125	105	113	94	102	85	10.345
26	219	212	202	196	185	178	167	162	120	98	109	89	98	79	11.189
27	211	202	195	185	178	169	161	153	116	92	105	83	94	75	12.066
28	204	192	188	177	171	161	155	146	112	87	101	78	91	70	12.977
29	197	183	181	168	166	153	150	139	108	82	97	74	88	66	13.920
30	190	174	175	160	160	146	145	132	104	77	94	69	85	62	14.897
31	184	166	169	153	155	139	140	126	101	73	91	65	82	59	15.906
32	178	159	164	146	150	133	136	120	98	69	88	62	79	55	16.949
33	173	151	159	139	145	127	132	115	95		86		77		18.025
34	168	145	155	133	141	121	128	110	92		83		75		19.134
35	163	138	150	127	137	116	124	105	89		81		73		20.276
36	158	132	146	122	133	111	121	101	87		78		71		21.451
37	154	127	142	116	130	106	118	96	85		76		69		22.659
38	150	121	138	112	126	102	115	92	82		74		67		23.901
39	146	117	135	107	123	98	112	88	80		72		65		25.175
40	143	112	131	103	120	93	109	85	78		71		64		26.483
41	139	107	128	99	117	90	106	81	76		69		62		27.823
42	136	103	125	94	114	86	104	78	74		67		61		29.197
43	133	98	122	91	112	82	101	75	73		66		59		30.604
44	130	95	119	87	109	79	99	71	71		64		58		32.044
45	127	91	117	83	107	76	97	69	69		63		56		33.517
46	124	87	114	80	104	73	95	66	68		61		55		35.023
47	121	84	112	77	102		93		67		60		54		36.563
48	119		109		100		91		65		59		53		38.135
49	116		107		98		89		64		58		52		39.741
50	114		105		96		87		63		56		51		41.379
51	112		103		94		85		61		55		50		43.051
52	110		101		92		84		60		54		49		44.756
53	108		99		91		82		59		53		48		46.494
54	106		97		89		81		58		52		47		48.265
55	104		96		87		79		57		51		46		50.069
56	102		94		86		78		56		50		45		51.906
57	100		92		84		76		55		49		45		53.777
58	98														55.680

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 244 24″x14″								CB 243 24″x12″						
	160 lbs.		150 lbs.		140 lbs.		130 lbs.		120 lbs.		110 lbs.		100 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									262	262	239	239	216	216	
13	330	330	309	309	287	287	265	265	248	248	227	227	207	207	2.797
14	313	313	293	293	274	274	254	254	230	230	211	211	192	192	3.244
15	292	292	274	274	255	255	237	237	215	215	197	197	179	179	3.724
16	274	274	257	257	239	239	222	222	201	201	185	185	168	168	4.237
17	258	258	242	242	225	225	209	209	189	189	174	174	158	158	4.783
18	243	243	228	228	213	213	198	198	179	179	164	164	149	149	5.363
19	231	231	216	216	202	202	187	187	169	169	155	155	141	141	5.975
20	219	219	205	205	192	192	178	178	161	161	148	148	134	134	6.621
21	209	209	196	196	182	182	169	169	153	152	141	138	128	126	7.299
22	199	199	187	187	174	174	162	162	146	142	134	130	122	118	8.011
23	191	191	179	179	167	167	155	155	140	134	128	122	117	111	8.756
24	183	181	171	170	160	158	148	147	134	126	123	115	112	105	9.534
25	175	172	164	161	153	150	142	139	129	119	118	109	107	99	10.345
26	169	163	158	152	147	142	137	132	124	113	114	103	103	94	11.189
27	162	155	152	145	142	135	132	125	119	107	109	97	99	89	12.066
28	156	147	147	138	137	128	127	119	115	101	105	92	96	84	12.977
29	151	140	142	131	132	122	123	114	111	96	102	88	93	80	13.920
30	146	134	137	125	128	116	119	108	107	91	98	83	89	76	14.897
31	141	128	132	119	124	111	115	103	104	86	95	79	87	72	15.906
32	137	121	128	114	120	106	111	98	101	82	92	75	84	68	16.949
33	133	116	124	109	116	101	108	94	98	78	89	71	81	65	18.025
34	129	111	121	104	113	97	105	90	95	74	87	68	79	62	19.134
35	125	106	117	99	109	92	102	86	92	71	84	65	77	59	20.276
36	122	102	114	95	106	89	99	82	89	67	82	62	75	56	21.451
37	118	97	111	91	104	85	96	79	87	64	80	59	73	53	22.659
38	115	93	108	87	101	81	94	75	85	61	78	56	71	51	23.901
39	112	89	105	83	98	78	91	72	83	58	76	54	69	48	25.175
40	110	86	103	80	96	74	89	69	81	56	74	51	67	46	26.483
41	107	82	100	77	93	72	87	66	79		72		65		27.823
42	104	79	98	74	91	68	85	64	77		70		64		29.197
43	102	76	95	71	89	66	83	61	75		69		62		30.604
44	100	72	93	68	87	63	81	58	73		67		61		32.044
45	97	70	91	65	85	61	79	56	72		66		60		33.517
46	95	67	89	62	83	58	77	54	70		64		58		35.023
47	93	64	87		82		76		69		63		57		36.563
48	91		86		80		74		67		62		56		38.135
49	89		84		78		73		66		60		55		39.741
50	88		82		77		71		64		59		54		41.379
51	86		81		75		70		63		58		53		43.051
52	84		79												44.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 242 24″x9¾″						CB 241 24″x8½″		CB 213 21″x13″						
	94 lbs.		85 lbs.		76 lbs.		70 lbs.		120 lbs.		112 lbs.		104 lbs.		
	Laterally						Laterally		Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
10	243 240	243 240	218 217	218 217	194 194	194 194	192 174	192 174							1.655
11	218	218	197	197	177	177	158	158							2.003
12	200	200	181	181	162	162	145	145	227	227	211	211	195	195	2.383
13	185	185	167	167	149	149	134	134	223	223	208	208	193	193	2.797
14	171	171	155	155	139	139	124	124	207	207	194	194	180	180	3.244
15	160	160	145	145	129	129	116	114	194	194	181	181	168	168	3.724
16	150	150	136	136	121	121	109	104	181	181	169	169	157	157	4.237
17	141	140	128	126	114	112	102	96	171	171	159	159	148	148	4.783
18	133	129	121	117	108	104	96	88	161	161	151	151	140	140	5.363
19	126	120	114	108	102	97	91	82	153	153	143	143	132	132	5.975
20	120	112	109	101	97	90	87	76	145	145	136	136	126	126	6.621
21	114	104	103	94	92	84	83	70	138	138	129	129	120	120	7.299
22	109	98	99	88	88	79	79	65	132	131	123	123	114	114	8.011
23	104	91	94	82	84	74	76	61	126	124	118	116	109	107	8.756
24	100	86	90	77	81	69	72	57	121	117	113	109	105	101	9.534
25	96	80	87	73	78	65	69	53	116	111	108	103	101	96	10.345
26	92	75	83	68	75	61	67	49	112	105	104	98	97	91	11.189
27	89	71	80	64	72	57	64	46	108	100	100	93	93	86	12.066
28	86	67	78	60	69	54	62	43	104	94	97	88	90	82	12.977
29	83	63	75	57	67	50	60		100	90	93	84	87	78	13.920
30	80	59	72	53	65	48	58		97	85	90	80	84	74	14.897
31	77	56	70	50	63	45	56		94	81	87	76	81	70	15.906
32	75	53	68	47	61	42	54		91	77	85	72	79	67	16.949
33	73		66		59		53		88	74	82	69	76	64	18.025
34	71		64		57		51		85	70	80	66	74	61	19.134
35	69		62		55		50		83	67	77	63	72	58	20.276
36	67		60		54		48		81	64	75	60	70	55	21.451
37	65		59		52		47		78	61	73	57	68	53	22.659
38	63		57		51		46		76	58	71	55	66	51	23.901
39	62		56		50		45		74	56	69	52	64	48	25.175
40	60		54		49		43		73	54	68	50	63	46	26.483
41	59		53		47		42		71	51	66	48	61	44	27.823
42	57		52		46		41		69	49	65	46	60	42	29.197
43	56		50		45		40		68		63		58		30.604
44	55		49		44		39		66		62		57		32.044
45	53		48		43		39		65		60		56		33.517
46	52		47		42		38								35.023
47	51		46		41		37								36.563
48	50		45		40		36								38.135
49	49		44		40		35								39.741
50	48		43		39		35								41.379
51	47		43		38		34								43.051

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 212 21″x9″						CB 211 21″x8″								
	92 lbs.		86 lbs.		80 lbs.		70 lbs.		64 lbs.		60 lbs.		58 lbs.		
	Laterally						Laterally								
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							184	184	167	167	158	158	151	151	
9	213	213	199	199	184	184	172	172	157	157	147	147	143	143	1.341
10	210	210	196	196	182	182	155	155	142	142	132	132	128	128	1.655
11	191	191	178	178	166	166	141	141	129	129	120	120	117	117	2.003
12	175	175	163	163	152	152	129	129	118	118	110	110	107	107	2.383
13	161	161	151	151	140	140	119	119	109	109	102	102	99	99	2.797
14	150	150	140	140	130	130	111	109	101	100	95	93	92	90	3.244
15	140	140	131	131	122	122	103	100	94	91	88	85	86	82	3.724
16	131	128	122	120	114	112	97	91	89	83	83	78	80	75	4.237
17	123	118	115	111	107	103	91	84	83	76	78	71	75	69	4.783
18	116	110	109	102	101	95	86	77	79	70	74	65	71	63	5.363
19	110	101	103	95	96	88	82	71	75	65	70	60	68	59	5.975
20	105	94	98	88	91	82	77	66	71	60	66	56	64	54	6.621
21	100	88	93	82	87	76	74	61	67	56	63	52	61	50	7.299
22	95	81	89	76	83	71	70	56	64	52	60	48	58	46	8.011
23	91	76	85	71	79	66	67	52	62	48	58	45	56	43	8.756
24	87	71	82	66	76	62	65	49	59	45	55	41	53	40	9.534
25	84	67	78	62	73	58	62	45	57	41	53	38	51	37	10.345
26	81	62	75	58	70	54	60	42	55	39	51	36	49	35	11.189
27	78	59	73	55	68	51	57		52		49		48		12.066
28	75	55	70	51	65	48	55		51		47		46		12.977
29	72	51	68	48	63	44	53		49		46		44		13.920
30	70	48	65	45	61	42	52		47		44		43		14.897
31	68		63		59		50		46		43		41		15.906
32	65		61		57		48		44		41		40		16.949
33	64		59		55		47		43		40		39		18.025
34	62		58		54		46		42		39		38		19.134
35	60		56		52		44		40		38		37		20.276
36	58		54		51		43		39		37		36		21.451
37	57		53		49		42		38		36		35		22.659
38	55		52		48		41		37		35		34		23.901
39	54		50		47		40		36		34		33		25.175
40	52		49		46		39		35		33		32		26.483
41	51		48		44		38		35		32		31		27.823
42	50		47		43		37		34		32		31		29.197
43	49		46		42		36		33		31		30		30.604
44	48		45		41		35		32		30		29		32.044
45	47		44		41		34		31		29		28		33.517

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 183 18″x12″						CB 182 18″x8½″						
	100 lbs.		93 lbs.		86 lbs.		78 lbs.		72 lbs.		67 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
9							172 171	172 171	158	158	146	146	1.341
10							154	154	142	142	132	132	1.655
11	182	182	168	168	154	154	140	140	129	129	120	120	2.003
12	174	174	162	162	150	150	129	129	119	119	110	110	2.383
13	160	160	149	149	138	138	119	119	109	109	102	102	2.797
14	149	149	139	139	128	128	110	110	102	102	95	95	3.244
15	139	139	129	129	120	120	103	101	95	93	88	87	3.724
16	130	130	121	121	112	112	96	93	89	85	83	80	4.237
17	123	123	114	114	106	106	91	85	84	78	78	73	4.783
18	116	116	108	108	100	100	86	79	79	73	74	67	5.363
19	110	110	102	102	94	94	81	73	75	67	70	62	5.975
20	104	104	97	97	90	90	77	67	71	62	66	58	6.621
21	99	98	92	91	85	84	73	63	68	58	63	53	7.299
22	95	92	88	85	82	79	70	58	65	54	60	50	8.011
23	91	87	84	80	78	74	67	54	62	50	58	46	8.756
24	87	82	81	76	75	70	64	50	59	47	55	43	9.534
25	83	77	78	72	72	66	62	47	57	43	53	40	10.345
26	80	73	75	68	69	63	59	44	55	41	51	38	11.189
27	77	69	72	64	66	59	57	41	53	38	49	35	12.066
28	75	65	69	61	64	56	55	39	51	35	47	33	12.977
29	72	62	67	58	62	53	53		49		46		13.920
30	70	59	65	55	60	50	51		47		44		14.897
31	67	56	63	52	58	48	50		46		43		15.906
32	65	53	61	49	56	46	48		44		41		16.949
33	63	51	59	47	54	43	47		43		40		18.025
34	61	48	57	45	53	41	45		42		39		19.134
35	60	46	55	42	51	39	44		41		38		20.276
36	58	44	54	40	50	37	43		40		37		21.451
37	56		52		49		42		38		36		22.659
38	55		51		47		41		37		35		23.901
39	53		50		46		40		36		34		25.175

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 181 18″x7½″								CB 165 16″x14″						
	58 lbs.		52 lbs.		51 lbs.		47 lbs.		115 lbs.		107 lbs.		100 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	143	143	128	128	135	135	115	115							
8	140	140	126	126	120	120	114	114							1.059
9	125	125	112	112	107	107	101	101							1.341
10	112	112	101	101	96	96	91	91							1.655
11	102	102	92	92	87	87	83	83							2.003
12	94	94	84	84	80	80	76	76	173	173	160	160	148	148	2.383
13	86	86	77	77	74	73	70	69	168	168	157	157	146	146	2.797
14	80	77	72	69	68	66	65	63	156	156	145	145	136	136	3.244
15	75	70	67	63	64	60	61	57	146	146	136	136	127	127	3.724
16	70	64	63	58	60	55	57	52	137	137	127	127	119	119	4.237
17	66	59	59	53	56	50	54	48	129	129	120	120	112	112	4.783
18	62	54	56	48	53	46	51	44	122	122	113	113	106	106	5.363
19	59	50	53	45	50	42	48	40	115	115	107	107	100	100	5.975
20	56	46	50	41	48	39	46	37	109	109	102	102	95	95	6.621
21	53	42	48	38	46	36	43	34	104	104	97	97	91	91	7.299
22	51	39	46	35	44	33	41	32	99	99	93	93	86	86	8.011
23	49	36	44	32	42	31	40	29	95	95	89	89	83	83	8.756
24	47	34	42	30	40	29	38	27	91	90	85	84	79	79	9.534
25	45	31	40	28	38	27	36	25	88	86	81	80	76	74	10.345
26	43		39		37		35		84	81	78	76	73	71	11.189
27	42		37		36		34		81	77	75	72	70	67	12.066
28	40		36		34		33		78	73	73	68	68	64	12.977
29	39		35		33		31		75	70	70	65	66	61	13.920
30	37		34		32		30		73	67	68	62	63	58	14.897
31	36		32		31		29		71	63	66	59	61	55	15.906
32	35		31		30		28		68	61	64	56	59	52	16.949
33	34		31		29		28		66		62		58		18.025
34	33		30		28		27		64		60		56		19.134
35	32		29		27		26		63		58		54		20.276
36	31		28		27		25								21.451
37	30		27		26		25								22.659
38	30		27		25		24								23.901
39	29		26		25		23								25.175

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	CB 164 16″x12″						CB 163 16″x8½″						Coefficient of Deflection
	90 lbs.		83 lbs.		76 lbs.		68 lbs.		63 lbs.		58 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							142.1	142.1	130.8	130.8	120.0	120.0	
9							134.9	134.9	125.0	125.0	115.1	115.1	1.341
10	160.8	160.8	147.7	147.7	134.1	134.1	121.4	121.4	112.5	112.5	103.5	103.5	1.655
11	152.3	152.3	140.5	140.5	128.6	128.6	110.4	110.4	102.3	102.3	94.1	94.1	2.003
12	139.6	139.6	128.8	128.8	117.9	117.9	101.2	101.2	93.8	93.8	86.3	86.3	2.383
13	128.9	128.9	118.9	118.9	108.8	108.8	93.4	93.4	86.5	86.5	79.7	79.7	2.797
14	119.7	119.7	110.4	110.4	101.1	101.1	86.7	86.7	80.4	80.4	74 0	74.0	3.244
15	111.7	111.7	103.0	103.0	94.3	94.3	81.0	79.7	75.0	73.8	69.0	68.2	3.724
16	104.7	104.7	96.6	96.6	88.4	88.4	75.9	72.9	70.3	67.6	64.7	62.2	4.237
17	98.6	98.6	90.9	90.9	83.2	83.2	71.4	67.3	66.2	62.0	60.9	57.1	4.783
18	93.1	93.1	85.9	85.9	78.6	78.6	67.5	61.9	62.5	57.4	57.5	52.6	5.363
19	88.2	88.2	81.3	81.3	74.5	74.5	63.9	57.2	59.2	53.0	54.5	48.7	5.975
20	83.8	83.8	77.3	77.3	70.8	70.8	60.7	53.1	56.3	49.0	51.8	45.1	6.621
21	79.8	78.9	73.6	72.4	67.4	66.3	57.8	49.3	53.6	45.6	49.3	41.8	7.299
22	76.2	74.1	70.2	68.1	64.3	62.3	55.2	45.9	51.1	42.4	47.1	39.0	8.011
23	72.8	69.7	67.2	64.0	61.5	58.6	52.8	42.7	48.9	39.6	45.0	36.2	8.756
24	69.8	65.7	64.4	60.4	59.0	55.3	50.6	39.7	46.9	36.8	43.1	33.7	9.534
25	67.0	62.0	61.8	57.0	56.6	52.2	48.6	37.2	45.0	34.3	41.4	31.5	10.345
26	64.4	58.7	59.4	53.9	54.4	49.3	46.7	34.7	43.3	32.1	39.8	29.4	11.189
27	62.1	55.5	57.2	51.0	52.4	46.7	45.0	32.5	41.7	30.0	38.4	27.6	12.066
28	59.8	52.6	55.2	48.3	50.5	44.2	43.4	30.3	40.2	27.9	37.0	25.7	12.977
29	57.8	49.9	53.3	45.8	48.8	41.9	41.9		38.8		35.7		13.920
30	55.9	47.3	51.5	43.5	47.2	39.8	40.5		37.5		34.5		14.897
31	54.0	45.0	49.9	41.3	45.6	37.8	39.2		36.3		33.4		15.906
32	52.4	42.7	48.3	39.2	44.2	35.9	38.0		35.2		32.4		16.949
33	50.8		46.8		42.9		36.8		34.1		31.4		18.025
34	49.3		45.5		41.6		35.7		33.1		30.5		19.134
35	47.9		44.2		40.4		34.7		32.1		29.6		20.276

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 162 16″x7″								CB 161 16″x6″				
	50 lbs.		45 lbs.		43 lbs.		40 lbs.		38 lbs.		35 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
6					119.5 116.9	119.5 116.9			100.6	100.6	92.4	92.4	0.596
7	117.7	117.7	105.2	105.2	100.2	100.2	92.8	92.8	90.4	90.4	83.3	83.3	0.811
8	109.3	109.3	98.4	98.4	87.7	87.7	87.4	87.4	79.1	79.1	72.9	72.9	1.059
9	97.1	97.1	87.4	87.4	77.9	77.9	77.7	77.7	70.3	70.3	64.8	64.8	1.341
10	87.4	87.4	78.7	78.7	70.1	70.1	69.9	69.9	63.3	63.3	58.3	58.3	1.655
11	79.5	79.5	71.5	71.5	63.8	63.8	63.6	63.6	57.5	55.7	53.0	51.4	2.003
12	72.8	72.6	65.6	65.1	58.4	58.2	58.3	57.8	52.7	49.4	48.6	45.6	2.383
13	67.2	65.1	60.5	58.4	53.9	52.3	53.8	51.9	48.7	44.1	44.9	40.7	2.797
14	62.4	58.8	56.2	52.7	50.1	47.2	50.0	46.8	45.2	39.6	41.7	36.4	3.244
15	58.3	53.3	52.5	48.0	46.8	42.7	46.6	42.4	42.2	35.6	38.9	32.8	3.724
16	54.6	48.4	49.2	43.6	43.8	39.0	43.7	38.6	39.6	32.1	36.5	29.6	4.237
17	51.4	44.4	46.3	39.8	41.3	35.6	41.1	35.2	37.2	29.2	34.3	26.8	4.783
18	48.6	40.6	43.7	36.4	39.0	32.6	38.9	32.3	35.2	26.5	32.4	24.3	5.363
19	46.0	37.2	41.4	33.3	36.9	29.8	36.8	29.6	33.3	24.1	30.7	22.1	5.975
20	43.7	34.1	39.3	30.7	35.1	27.5	35.0	27.2	31.6	21.9	29.2	20.0	6.621
21	41.6	31.4	37.5	28.3	33.4	25.3	33.3	25.0	30.1		27.8		7.299
22	39.7	29.0	35.8	26.0	31.9	23.3	31.8	23.0	28.8		26.5		8.011
23	38.0	26.7	34.2	23.9	30.5	21.4	30.4	21.1	27.5		25.4		8.756
24	36.4		32.8		29.2		29.1		26.4		24.3		9.534
25	35.0		31.5		28.1		28.0		25.3		23.3		10.345
26	33.6		30.3		27.0		26.9		24.3		22.4		11.189
27	32.4		29.1		26.0		25.9		23.4		21.6		12.066
28	31.2		28.1		25.0		25.0		22.6		20.8		12.977
29	30.1		27.1		24.2		24.1		21.8		20.1		13.920
30	29.1		26.2		23.4		23.3		21.1		19.4		14.897
31	28.2		25.4		22.6		22.6		20.4		18.8		15.906
32	27.3		24.6		21.9		21.9		19.8		18.2		16.949
33	26.5		23.8		21.3		21.2		19.2		17.7		18.025
34	25.7		23.1		20.6		20.6		18.6		17.2		19.134
35	25.0		22.5				20.0		18.1				20.276

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 145 14″x12″						CB 144 14″x10″						
	105 lbs.		95 lbs.		85 lbs.		75 lbs.		68 lbs.		61 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
10							134.6 / 122.2	134.6 / 122.2	121.0 / 110.7	121.0 / 110.7	107.7 / 99.3	107.7 / 99.3	1.655
11	154.0	154.0	137.6	137.6	121.8	121.8	111.0	111.0	100.6	100.6	90.3	90.3	2.003
12	144.7	144.7	130.8	130.8	117.0	117.0	101.8	101.8	92.2	92.2	82.8	82.8	2.383
13	133.6	133.6	120.8	120.8	108.0	108.0	94.0	94.0	85.2	85.2	76.4	76.4	2.797
14	124.0	124.0	112.1	112.1	100.3	100.3	87.3	87.3	79.1	79.1	71.0	71.0	3.244
15	115.8	115.8	104.7	104.7	93.6	93.6	81.4	81.4	73.8	73.8	66.2	66.2	3.724
16	108.5	108.5	98.1	98.1	87.7	87.7	76.3	76.3	69.2	69.2	62.1	62.1	4.237
17	102.1	102.1	92.4	92.4	82.6	82.6	71.9	71.6	65.1	64.9	58.4	58.0	4.783
18	96.5	96.5	87.2	87.2	78.0	78.0	67.9	66.3	61.5	60.1	55.2	53.9	5.363
19	91.4	91.4	82.6	82.6	73.9	73.9	64.3	61.8	58.3	55.8	52.3	50.0	5.975
20	86.8	86.8	78.5	78.5	70.2	70.2	61.1	57.5	55.4	51.9	49.7	46.6	6.621
21	82.7	81.7	74.8	73.6	66.9	65.8	58.2	53.6	52.7	48.6	47.3	43.4	7.299
22	78.9	76.8	71.4	69.1	63.8	61.8	55.5	50.1	50.3	45.4	45.2	40.6	8.011
23	75.5	72.3	68.3	65.1	61.0	58.2	53.1	47.1	48.1	42.5	43.2	38.1	8.756
24	72.4	68.1	65.4	61.3	58.5	54.8	50.9	44.1	46.1	39.8	41.4	35.7	9.534
25	69.5	64.3	62.8	57.9	56.2	51.8	48.9	41.4	44.3	37.5	39.7	33.5	10.345
26	66.8	60.8	60.4	54.7	54.0	48.9	47.0	38.9	42.6	35.3	38.2	31.5	11.189
27	64.3	57.5	58.1	51.8	52.0	46.3	45.2	36.8	41.0	33.2	36.8	29.6	12.066
28	62.0	54.5	56.1	49.1	50.1	43.9	43.6	34.6	39.5	31.2	35.5	28.0	12.977
29	59.9		54.1		48.4		42.1		38.2		34.3		13.920
30	57.9		52.3		46.8		40.7		36.9		33.1		14.897
31	56.0		50.6		45.3		39.4		35.7		32.0		15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 143 14″x8″						CB 142 14″x6¾″				
	58 lbs.		53 lbs.		48 lbs.		42 lbs.		39 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
							97.4	97.4	90.1	90.1	
7	117.6	117.6	106.8	106.8	96.0	96.0	92.4	92.4	85.7	85.7	0.811
8	114.1	114.1	104.3	104.3	94.5	94.5	80.8	80.8	75.0	75.0	1.059
9	101.4	101.4	92.7	92.7	84.0	84.0	71.8	71.8	66.7	66.7	1.341
10	91.3	91.3	83.5	83.5	75.6	75.6	64.6	64.6	60.0	60.0	1.655
11	83.0	83.0	75.9	75.9	68.7	68.7	58.8	58.8	54.6	54.6	2.003
12	76.1	76.1	69.6	69.6	63.0	63.0	53.9	53.0	50.0	49.0	2.383
13	70.2	70.2	64.2	64.2	58.1	58.1	49.7	47.6	46.2	44.0	2.797
14	65.2	64.4	59.6	58.7	54.0	53.1	46.2	42.8	42.9	39.7	3.244
15	60.9	58.7	55.6	53.5	50.4	48.4	43.1	38.7	40.0	35.9	3.724
16	57.1	53.7	52.2	48.9	47.2	44.3	40.4	35.2	37.5	32.7	4.237
17	53.7	49.3	49.1	44.9	44.5	40.6	38.0	32.1	35.3	29.8	4.783
18	50.7	45.4	46.4	41.3	42.0	37.4	35.9	29.3	33.3	27.2	5.363
19	48.0	41.9	43.9	38.1	39.8	34.5	34.0	26.8	31.6	24.9	5.975
20	45.6	38.7	41.7	35.4	37.8	31.9	32.3	24.6	30.0	22.9	6.621
21	43.5	35.8	39.7	32.8	36.0	29.5	30.8	22.6	28.6	21.0	7.299
22	41.5	33.2	37.9	30.4	34.4	27.4	29.4	20.8	27.3	19.3	8.011
23	39.7	30.8	36.3	28.2	32.9	25.4	28.1		26.1		8.756
24	38.0	28.7	34.8	26.2	31.5	23.6	26.9		25.0		9.534
25	36.5	26.7	33.4	24.4	30.2	22.0	25.9		24.0		10.345
26	35.1	24.8	32.1	22.7	29.1	20.4	24.9		23.1		11.189
27	33.8		30.9		28.0		23.9		22.2		12.066
28	32.6		29.8		27.0		23.1		21.4		12.977
29	31.5		28.8		26.1		22.3		20.7		13.920
30	30.4		27.8		25.2		21.5		20.0		14.897
31	29.4		26.9		24.4		20.9		19.4		15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 142 14″x6¾″						CB 141 14′x6″		
	38 lbs.		36 lbs.		33 lbs.		30 lbs.		
	Laterally						Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	105.0	105.0					75.4	75.4	
6	90.8	90.8	82.8	82.8	75.6	75.6	74.3	74.3	0.596
7	77.8	77.8	79.1	79.1	72.6	72.6	63.7	63.7	0.811
8	68.1	68.1	69.3	69.3	63.5	63.5	55.8	55.8	1.059
9	60.5	60.5	61.6	61.6	56.5	56.5	49.6	49.6	1.341
10	54.5	54.5	55.4	55.4	50.8	50.8	44.6	44.6	1.655
11	49.5	49.5	50.4	50.4	46.2	46.2	40.5	39.3	2.003
12	45.4	44.7	46.2	45.3	42.3	41.5	37.2	34.8	2.383
13	41.9	40.1	42.6	40.6	39.1	37.3	34.3	31.1	2.797
14	38.9	36.2	39.6	36.6	36.3	33.5	31.9	27.9	3.244
15	36.3	32.8	36.9	33.2	33.9	30.3	29.7	25.1	3.724
16	34.0	29.8	34.6	30.2	31.8	27.5	27.9	22.7	4.237
17	32.0	27.2	32.6	27.5	29.9	25.1	26.2	20.5	4.783
18	30.3	24.8	30.8	25.0	28.2	22.9	24.8	18.6	5.363
19	28.7	22.7	29.2	22.9	26.7	21.0	23.5	16.9	5.975
20	27.2	20.9	27.7	21.0	25.4	19.3	22.3	15.3	6.621
21	25.9	19.2	26.4	19.3	24.2	17.7	21.2		7.299
22	24.8	17.6	25.2	17.7	23.1	16.2	20.3		8.011
23	23.7		24.1		22.1		19.4		8.756
24	22.7		23.1		21.2		18.6		9.534
25	21.8		22.2		20.3		17.8		10.345
26	21.0		21.3		19.5		17.2		11.189
27	20.2		20.5		18.8		16.5		12.066
28	19.5		19.8		18.1		15.9		12.977
29	18.8		19.1		17.5		15.4		13.920
30	18.2		18.5		16.9		14.9		14.897
31	17.6		17.9		16.4				15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 124 12″x10″								CB 123 12″x8″				
	100 lbs.		91 lbs.		83 lbs.		75 lbs.		50 lbs.		45 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
5	269.0 / 234.3	269.0 / 234.3	216.0	216.0									0.414
6	195.3	195.3	185.8	185.8	169.0	169.0							0.596
7	167.4	167.4	159.3	159.3	152.1	152.1			88.5	88.5	79.1	79.1	0.811
8	146.4	146.4	139.4	139.4	133.1	133.1	121.9	121.9	87.1	87.1	78.5	78.5	1.059
9	130.2	130.2	123.9	123.9	118.3	118.3	112.7	112.7	77.5	77.5	69.7	69.7	1.341
10	117.2	117.2	111.5	111.5	106.5	106.5	101.5	101.5	69.7	69.7	62.8	62.8	1.655
11	106.5	106.5	101.4	101.4	96.8	96.8	92.2	92.2	63.4	63.4	57.1	57.1	2.003
12	97.6	97.6	92.9	92.9	88.7	88.7	84.5	84.5	58.1	58.1	52.3	52.3	2.383
13	90.1	90.1	85.8	85.8	81.9	81.9	78.0	78.0	53.6	53.6	48.3	48.3	2.797
14	83.7	83.7	79.6	79.6	76.1	76.1	72.5	72.5	49.8	49.2	44.8	44.1	3.244
15	78.1	78.1	74.3	74.3	71.0	71.0	67.6	67.6	46.5	44.8	41.8	40.2	3.724
16	73.2	73.2	69.7	69.7	66.5	66.5	63.4	63.4	43.6	41.0	39.2	36.8	4.237
17	68.9	68.9	65.6	65.6	62.6	62.6	59.7	59.2	41.0	37.6	36.9	33.8	4.783
18	65.1	64.8	61.9	61.2	59.2	58.0	56.4	55.0	38.7	34.6	34.9	31.1	5.363
19	61.7	60.2	58.7	56.9	56.0	54.1	53.4	51.1	36.7	32.0	33.0	28.8	5.975
20	58.6	56.3	55.7	53.1	53.2	50.3	50.7	47.6	34.9	29.5	31.4	26.6	6.621
21	55.8	52.5	53.1	49.6	50.7	46.9	48.3	44.4	33.2	27.4	29.9	24.6	7.299
22	53.3	49.1	50.7	46.3	48.4	43.9	46.1	41.4	31.7	25.4	28.5	22.8	8.011
23	50.9	46.2	48.5	43.6	46.3	41.2	44.1	38.9	30.3	23.6	27.3	21.2	8.756
24	48.8	43.3	46.5	40.8	44.4	38.6	42.3	36.5	29.0	21.9	26.2	19.7	9.534
25	46.9		44.6		42.6		40.6		27.9		25.1		10.345
26	45.1		42.9		41.0		39.0		26.8		24.1		11.189
27	43.4		41.3		39.4		37.6		25.8		23.2		12.066

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 123 12″x8″		CB 122 12″x6½″								CB 121 12″x6″		
	40 lbs.		36 lbs.		34 lbs.		32 lbs.		28 lbs.		25 lbs.		
	Laterally		Laterally								Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
5					90.2 84.5	90.2 84.5					57.2	57.2	0.414
6			75.4	75.4	70.4	70.4	66.4	66.4	57.6	57.6	54.6	54.6	0.596
7			69.8	69.8	60.4	60.4	62.0	62.0	53.2	53.2	46.8	46.8	0.811
8	69.6	69.6	61.0	61.0	52.8	52.8	54.2	54.2	47.4	47.4	40.9	40.9	1.059
9	62.0	62.0	54.3	54.3	46.9	46.9	48.2	48.2	42.2	42.2	36.4	36.4	1.341
10	55.8	55.8	48.8	48.8	42.3	42.3	43.4	43.4	37.9	37.9	32.7	32.7	1.655
11	50.7	50.7	44.4	44.4	38.4	38.4	39.4	39.3	34.5	34.4	29.8	28.8	2.003
12	46.5	46.5	40.7	39.6	35.2	34.2	36.1	35.0	31.6	30.5	27.3	25.6	2.383
13	42.9	42.9	37.6	35.4	32.5	30.7	33.4	31.3	29.2	27.4	25.2	22.8	2.797
14	39.8	39.2	34.9	31.9	30.2	27.7	31.0	28.2	27.1	24.7	23.4	20.5	3.244
15	37.2	35.7	32.6	28.9	28.2	25.0	28.9	25.5	25.3	22.2	21.8	18.4	3.724
16	34.9	32.7	30.5	26.1	26.4	22.7	27.1	23.1	23.7	20.2	20.5	16.6	4.237
17	32.8	30.0	28.7	23.8	24.9	20.7	25.5	21.0	22.3	18.3	19.3	15.0	4.783
18	31.0	27.6	27.1	21.7	23.5	18.9	24.1	19.2	21.1	16.7	18.2	13.6	5.363
19	29.4	25.5	25.7	19.9	22.2	17.3	22.8	17.5	20.0	15.3	17.2	12.4	5.975
20	27.9	23.5	24.4	18.1	21.1	15.8	21.7	16.0	19.0	13.9	16.4	11.3	6.621
21	26.6	21.8	23.3	16.6	20.1	14.5	20.7	14.7	18.1	12.8	15.6		7.299
22	25.4	20.2	22.2		19.2	13.3	19.7		17.2		14.9		8.011
23	24.2	18.8	21.2		18.4		18.9		16.5		14.2		8.756
24	23.2	17.4	20.3		17.6		18.1		15.8		13.6		9.534
25	22.3		19.5		16.9		17.3		15.2		13.1		10.345
26	21.5		18.8		16.3		16.7		14.6		12.6		11.189
27	20.7		18.1		15.6		16.1		14.1				12.066

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 103 10″x9″						CB 102 10″x8″						
	63 lbs.		56 lbs.		49 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
4	157.4	157.4					128.8	128.8					
5	128.2	128.2	116.2	116.2			101.5	101.5	93.4	93.4			0.265
6	106.8	106.8	100.7	100.7			81.2	81.2	74.9	74.9	64.0	64.0	0.414
7	91.5	91.5	86.3	86.3	75.0	75.0	67.7	67.7	62.4	62.4	58.1	58.1	0.596
8	80.1	80.1	75.5	75.5	70.9	70.9	58.0	58.0	53.5	53.5	49.8	49.8	0.811
9	71.2	71.2	67.1	67.1	63.1	63.1	50.8	50.8	46.8	46.8	43.6	43.6	1.059
10	64.1	64.1	60.4	60.4	56.8	56.8	45.1	45.1	41.6	41.6	38.7	38.7	1.341
11	58.3	58.3	54.9	54.9	51.6	51.6	40.6	40.6	37.5	37.5	34.8	34.8	1.655
12	53.4	53.4	50.3	50.3	47.3	47.3	36.9	36.9	34.1	34.1	31.7	31.7	2.003
13	49.3	49.3	46.5	46.5	43.7	43.7	33.8	33.8	31.2	31.2	29.0	29.0	2.383
14	45.8	45.8	43.2	43.2	40.5	40.5	31.2	31.2	28.8	28.8	26.8	26.8	2.797
15	42.7	42.7	40.3	40.3	37.8	37.8	29.0	28.9	26.8	26.6	24.9	24.5	3.244
16	40.0	39.7	37.8	37.3	35.5	34.8	27.1	26.4	25.0	24.2	23.2	22.3	3.724
17	37.7	36.7	35.5	34.3	33.4	31.9	25.4	24.2	23.4	22.1	21.8	20.4	4.237
18	35.6	33.9	33.6	31.7	31.5	29.6	23.9	22.2	22.0	20.3	20.5	18.7	4.783
19	33.7	31.5	31.8	29.4	29.9	27.4	22.6	20.4	20.8	18.7	19.4	17.2	5.363
20	32.0	29.3	30.2	27.4	28.4	25.4	21.4	18.9	19.7	17.3	18.3	15.9	5.975
21	30.5		28.8		27.0		20.3	17.5	18.7	16.0	17.4	14.7	6.621
22	29.1		27.5		25.8		19.3		17.8		16.6		7.299
23	27.9		26.3		24.7		18.5		17.0		15.8		8.011
							17.7		16.3		15.2		8.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 101 10″x6″								CB 93 9″x9″						
	30 lbs.		26 lbs.		23 lbs.		21 lbs.		48 lbs.		43 lbs.		38 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	61.0	61.0	52.3	52.3	46.0	46.0	45.6	45.6							
6	56.7	56.7	49.1	49.1	43.4	43.4	38.6	38.6	73.6	73.6					0.596
7	48.6	48.6	42.1	42.1	37.2	37.2	33.1	33.1	72.9	72.9	65.1	65.1	56.9	56.9	0.811
8	42.6	42.6	36.8	36.8	32.6	32.6	29.0	29.0	63.8	63.8	57.2	57.2	50.5	50.5	1.059
9	37.8	37.8	32.7	32.7	29.0	29.0	25.8	25.8	56.7	56.7	50.8	50.8	44.9	44.9	1.341
10	34.0	34.0	29.5	29.5	26.1	26.1	23.2	23.2	51.0	51.0	45.7	45.7	40.4	40.4	1.655
11	30.9	30.1	26.8	26.0	23.7	23.0	21.1	20.4	46.4	46.4	41.6	41.6	36.7	36.7	2.003
12	28.4	26.7	24.6	23.0	21.7	20.4	19.3	18.1	42.5	42.5	38.1	38.1	33.7	33.7	2.383
13	26.2	23.8	22.7	20.6	20.0	18.2	17.8	16.2	39.3	39.3	35.2	35.2	31.1	31.1	2.797
14	24.3	21.4	21.1	18.5	18.6	16.3	16.6	14.5	36.5	36.5	32.7	32.7	28.9	28.9	3.244
15	22.7	19.2	19.6	16.7	17.4	14.7	15.5	13.0	34.0	34.0	30.5	30.5	26.9	26.9	3.724
16	21.3	17.4	18.4	15.0	16.3	13.2	14.5	11.8	31.9	31.3	28.6	28.0	25.2	24.8	4.237
17	20.0	15.8	17.3	13.6	15.3	12.0	13.6	10.7	30.0	28.8	26.9	25.8	23.8	22.7	4.783
18	18.9	14.3	16.4	12.3	14.5	10.9	12.9	9.7	28.4	26.7	25.4	23.8	22.4	21.0	5.363
19	17.9	13.0	15.5	11.2	13.7	9.9	12.2	8.8	26.9		24.1		21.3		5.975
20	17.0	11.8	14.7	10.2	13.0	9.0	11.6		25.5		22.9		20.2		6.621
21	16.2		14.0		12.4		11.0		24.3		21.8		19.2		7.299
22	15.5		13.4		11.8		10.5								8.011
23	14.8		12.8		11.3										8.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Concluded

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 92 9″x6½″						CB 83 8″x8″						
	35 lbs.		32 lbs.		29 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	61.6	61.6	55.9	55.9	50.2	50.2							
6	60.1	60.1	54.9	54.9	49.8	49.8	65.2	65.2	55.1	55.1	46.7	46.7	0.596
7	51.5	51.5	47.1	47.1	42.7	42.7	57.0	57.0	48.8	48.8	41.9	41.9	0.811
8	45.1	45.1	41.2	41.2	37.3	37.3	49.8	49.8	42.7	42.7	36.7	36.7	1.059
9	40.1	40.1	36.6	36.6	33.2	33.2	44.3	44.3	38.0	38.0	32.6	32.6	1.341
10	36.1	36.1	33.0	33.0	29.9	29.9	39.9	39.9	34.2	34.2	29.4	29.4	1.655
11	32.8	32.7	30.0	29.8	27.2	27.0	36.2	36.2	31.1	31.1	26.7	26.7	2.003
12	30.1	29.1	27.5	26.6	24.9	24.0	33.2	33.2	28.5	28.5	24.5	24.5	2.383
13	27.8	26.1	25.4	23.8	23.0	21.5	30.7	30.7	26.3	26.3	22.6	22.6	2.797
14	25.8	23.5	23.5	21.4	21.3	19.4	28.5	28.1	24.4	24.0	21.0	20.6	3.244
15	24.1	21.2	22.0	19.4	19.9	17.5	26.6	25.6	22.8	22.0	19.6	18.8	3.724
16	22.5	19.3	20.6	17.5	18.7	15.9	24.9	23.5	21.4	20.1	18.3	17.2	4.237
17	21.2	17.6	19.4	16.0	17.6	14.4	23.5		20.1		17.3		4.783
18	20.0	16.0	18.5	14.8	16.6	13.2	22.2		19.0		16.3		5.363
19	19.0		17.3		15.7		21.0		18.0		15.5		5.975
20	18.0		16.5		14.9								6.621
21	17.2		15.7		14.2								7.299

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 82 8″x6½″						*B 40 9″x5¼″				
	30 lbs.		27 lbs.		24 lbs.		25 lbs.		21 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3							68.4	68.4			0.149
4							56.6	56.6	45.0	45.0	0.265
5	48.8	48.8	43.4	43.4	38.2	38.2	45.3	45.3	41.5	41.5	0.414
6	46.8	46.8	42.1	42.1	37.4	37.4	37.7	37.7	34.6	34.6	0.596
7	40.1	40.1	36.1	36.1	32.1	32.1	32.3	32.3	29.7	29.7	0.811
8	35.1	35.1	31.6	31.6	28.1	28.1	28.3	28.3	26.0	26.0	1.059
9	31.2	31.2	28.1	28.1	25.0	25.0	25.1	25.1	23.1	22.9	1.341
10	28.1	28.1	25.3	25.3	22.5	22.5	22.6	21.8	20.8	19.9	1.655
11	25.5	25.4	23.0	22.9	20.4	20.3	20.6	19.1	18.9	17.3	2.003
12	23.4	22.7	21.0	20.4	18.7	18.1	18.9	16.9	17.3	15.3	2.383
13	21.6	20.3	19.4	18.2	17.3	16.2	17.4	15.0	16.0	13.5	2.797
14	20.1	18.3	18.0	16.4	16.0	14.6	16.2	13.3	14.8	12.0	3.244
15	18.7	16.5	16.8	14.9	15.0	13.2	15.1	11.9	13.8	10.8	3.724
16	17.5	15.0	15.8	13.4	14.0	12.0	14.1	10.7	13.0	9.6	4.237
17	16.5		14.9		13.2		13.3	9.6	12.2	8.6	4.783
18	15.6		14.0		12.5		12.6		11.5		5.363
19	14.8		13.3		11.8		11.9		10.9		5.975
20							11.3		10.4		6.621
21							10.8		9.9		7.299

*Standard Mill Section.

Loads above upper horizontal lines will produce maximum allowable shear in webs.

Loads below lower horizontal lines will produce excessive deflections.

For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

STANDARD MILL SECTIONS

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of New York Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	B 39 8″x5″				H 4 8″x8″						
	21 lbs.		18 lbs.		37.7 lbs.		34.3 lbs.		32.6 lbs.		
	Laterally				Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3	57.6 56.4	57.6 56.4	40.0	40.0							0.149
4	42.3	42.3	39.2	39.2	80.0 64.4	80.0 64.4	60.0	60.0			0.265
5	33.8	33.8	31.3	31.3							0.414
6	28.2	28.2	26.1	26.1	53.7	53.7	51.4	51.4	50.1	50.1	0.596
7	24.2	24.2	22.4	22.4	46.0	46.0	44.0	44.0	43.0	43.0	0.811
8	21.1	21.1	19.6	19.6	40.3	40.3	38.5	38.5	37.6	37.6	1.059
9	18.8	18.4	17.4	17.0	35.8	35.8	34.3	34.3	33.4	33.4	1.341
10	16.9	16.0	15.7	14.7	32.2	32.2	30.8	30.8	30.1	30.1	1.655
11	15.4	14.0	14.2	12.8	29.3	29.3	28.0	28.0	27.3	27.3	2.003
12	14.1	12.3	13.1	11.3	26.8	26.8	25.7	25.7	25.1	25.1	2.383
13	13.0	10.9	12.1	9.9	24.8	24.8	23.7	23.7	23.1	23.1	2.797
14	12.1	9.6	11.2	8.8	23.0	22.7	22.0	21.7	21.5	21.1	3.244
15	11.3	8.6	10.4	7.8	21.4	20.7	20.6	19.7	20.1	19.2	3.724
16	10.6	7.7	9.8	7.0	20.1	19.0	19.3	18.1	18.8	17.6	4.237
17	10.0		9.2		19.0		18.1		17.7		4.783
18	9.4		8.7		17.9		17.1		16.7		5.363
19	8.1		7.5		15.3		14.7		14.3		5.975

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	H 3-A 6″x6″				H 3 6″x6″				H 2 5″x5″		H 1 4″x4″		
	27.5 lbs.		25 lbs.		22.5 lbs.		20 lbs.		18.9 lbs.		13.8 lbs.		
	Laterally				Laterally				Laterally		Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3	52.6	52.6			45.0	45.0			31.3	31.3	25.0 18.8	25.0 18.8	0.149
4	43.8	43.8	37.6	37.6	36.5	36.5	30.0	30.0	25.3	25.3	14.1	14.1	0.265
5	35.0	35.0	33.4	33.4	29.2	29.2	27.6	27.6	20.3	20.3	11.3	11.3	0.414
6	29.2	29.2	27.9	27.9	24.3	24.3	23.0	23.0	16.9	16.9	9.4	9.4	0.596
7	25.0	25.0	23.9	23.9	20.8	20.8	19.7	19.7	14.5	14.5	8.1	8.0	0.811
8	21.9	21.9	20.9	20.9	18.2	18.2	17.2	17.2	12.7	12.7	7.1	6.6	1.059
9	19.5	19.5	18.6	18.6	16.2	16.2	15.3	15.3	11.3	11.0	6.3		1.341
10	17.5	17.5	16.7	16.7	14.6	14.6	13.8	13.7	10.1	9.5	5.7		1.655
11	15.9	15.5	15.2	14.7	13.3	12.9	12.5	12.1	9.2		5.1		2.003
12	14.6	13.7	13.9	13.0	12.2	11.4	11.5	10.7	8.4				2.383
13	13.5		12.9		11.2		10.6		7.8				2.797
14	12.5		11.9		10.4		9.9						3.244
15	11.7		11.1		9.7		9.2						3.724

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch
City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 302 30″x14″								CB 301 30″x10½″						
	240 lbs.		220 lbs.		200 lbs.		180 lbs.		135 lbs.		125 lbs.		115 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									376	376	347	347	318	318	
12									347	347	321	321	295	295	2.383
13									320	320	296	296	273	273	2.797
14	547	547	498	498	450	450	402	402	297	297	275	275	253	253	3.244
15	525	525	481	481	437	437	394	394	277	277	257	257	236	236	3.724
16	492	492	451	451	410	410	369	369	260	260	241	241	222	222	4.237
17	463	463	424	424	386	386	347	347	245	245	227	227	209	209	4.783
18	437	437	401	401	364	364	328	328	231	231	214	214	197	197	5.363
19	414	414	380	380	345	345	311	311	219	219	203	203	187	187	5.975
20	394	394	361	361	328	328	295	295	208	208	193	193	177	177	6.621
21	375	375	343	343	312	312	281	281	198	198	183	183	169	169	7.299
22	358	358	328	328	298	298	268	268	189	189	175	175	161	161	8.011
23	342	342	314	314	285	285	257	257	181	179	167	165	154	152	8.756
24	328	328	301	301	273	273	246	246	173	170	160	157	148	144	9.534
25	315	315	289	289	262	262	236	236	166	161	154	149	142	137	10.345
26	303	303	277	277	252	252	227	227	160	153	148	141	136	130	11.189
27	291	291	267	267	243	243	219	219	154	145	143	134	131	124	12.066
28	281	281	258	258	234	234	211	211	149	139	138	128	127	118	12.977
29	271	271	249	249	226	226	204	204	143	132	133	122	122	112	13.920
30	262	262	240	239	219	217	197	195	139	126	128	117	118	107	14.897
31	254	251	233	230	212	209	190	187	134	121	124	111	114	102	15.906
32	246	241	225	221	205	200	184	180	130	115	120	107	111	98	16.949
33	238	232	219	212	199	193	179	173	126	110	117	102	107	94	18.025
34	231	223	212	204	193	185	174	166	122	106	113	98	104	90	19.134
35	225	215	206	196	187	178	169	160	119	101	110	94	101	86	20.276
36	219	207	200	189	182	172	164	154	116		107		98		21.451
37	213	199	195	183	177	166	160	149	112		104		96		22.659
38	207	192	190	176	173	160	155	144	109		101		93		23.901
39	202	186	185	170	168	154	151	139	107		99		91		25.175
40	197	180	180	164	164	149	148	134	104		96		89		26.483
41	192	174	176	159	160	144	144	129	101		94		86		27.823
42	187	168	172	153	156	139	141	125	99		92		84		29.197
43	183	162	168	148	153	135	137	121	97		90		82		30.604
44	179	157	164	144	149	130	134	117	95		88		81		32.044
45	175	152	160	139	146	126	131	113	92		86		79		33.517
46	171	147	157	135	143	122	128	110	90		84		77		35.023
47	167	143	153	131	140		126		89		82		75		36.563
48	164		150		137		123		87		80		74		38.135
49	161		147		134		120		85		79		72		39.741
50	157		144		131		118		83		77		71		41.379
51	154		141		129		116		82		76		70		43.051
52	151		139		126		114		80		74		68		44.756
53	149		136		124		111		78		73		67		46.494
54	146		134		121		109		77		71		66		48.265
55	143		131		119		107		76		70		64		50.069
56	141		129		117		105		74		69		63		51.906
57	138		127		115		104		73		68		62		53.777
58	136		124		113		102		72		66		61		55.680
59	133		122		111		100		70		65		60		57.617
60	131		120		109		98		69		64		59		59.586
61	129		118		108		97		68		63		58		61.589
62	127		116		106		95		67		62		57		63.625

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 272 27″x14″								CB 271 27″x9¾″						
	190 lbs.		175 lbs.		160 lbs.		145 lbs.		112 lbs.		101 lbs.		91 lbs.		
	Laterally								Lateraly						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									309	309	277	277	249	249	
11									284	284	257	257	231	231	2.003
12									261	261	235	235	212	212	2.383
13	417	417	383	383	348	348	313	313	241	241	217	217	196	196	2.797
14	407	407	375	375	343	343	311	311	223	223	202	202	182	182	3.244
15	380	380	350	350	320	320	290	290	208	208	188	188	169	169	3.724
16	356	356	328	328	300	300	272	272	195	195	176	176	159	159	4.237
17	335	335	309	309	282	282	256	256	184	184	166	166	150	150	4.783
18	317	317	292	292	267	267	242	242	174	174	157	157	141	141	5.363
19	300	300	276	276	253	253	229	229	165	165	149	149	134	134	5.975
20	285	285	263	263	240	240	218	218	156	156	141	141	127	127	6.621
21	272	272	250	250	229	229	207	207	149	148	134	133	121	120	7.299
22	259	259	239	239	218	218	198	198	142	140	128	126	116	113	8.011
23	248	248	228	228	209	209	189	189	136	132	123	119	111	107	8.756
24	238	238	219	219	200	200	181	181	130	125	118	112	106	101	9.534
25	228	228	210	210	192	192	174	174	125	118	113	107	102	96	10.345
26	219	219	202	202	185	185	167	167	120	112	109	101	98	91	11.189
27	211	211	195	195	178	178	161	161	116	107	105	96	94	86	12.066
28	204	204	188	188	171	171	155	155	112	102	101	91	91	82	12.977
29	197	197	181	181	166	166	150	150	108	97	97	87	88	78	13.920
30	190	189	175	174	160	159	145	144	104	92	94	83	85	75	14.897
31	184	182	169	167	155	153	140	138	101	88	91	79	82	71	15.906
32	178	174	164	161	150	147	136	133	98	84	88	76	79	68	16.949
33	173	168	159	154	145	141	132	128	95		86		77		18.025
34	168	161	155	148	141	136	128	123	92		83		75		19.134
35	163	155	150	143	137	131	124	118	89		81		73		20.276
36	158	150	146	138	133	126	121	114	87		78		71		21.451
37	154	144	142	133	130	121	118	110	85		76		69		22.659
38	150	139	138	128	126	117	115	106	82		74		67		23.901
39	146	135	135	124	123	113	112	102	80		72		65		25.175
40	143	130	131	120	120	109	109	99	78		71		64		26.483
41	139	126	128	116	117	105	106	95	76		69		62		27.823
42	136	121	125	112	114	102	104	92	74		67		61		29.197
43	133	117	122	108	112	99	101	89	73		66		59		30.604
44	130	114	119	105	109	95	99	86	71		64		58		32.044
45	127	110	117	101	107	92	97	84	69		63		56		33.517
46	124	107	114	98	104	89	95	81	68		61		55		35.023
47	121	103	112	95	102		93		67		60		54		36.563
48	119		109		100		91		65		59		53		38.135
49	116		107		98		89		64		58		52		39.741
50	114		105		96		87		63		56		51		41.379
51	112		103		94		85		61		55		50		43.051
52	110		101		92		84		60		54		49		44.756
53	108		99		91		82		59		53		48		46.494
54	106		97		89		81		58		52		47		48.265
55	104		96		87		79		57		51		46		50.069
56	102		94		86		78		56		50		45		51.906
57	100		92		84		76		55		49		45		53.777
58	98														55.680

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 244 24″x14″								CB 243 24″x12″						
	160 lbs.		150 lbs.		140 lbs.		130 lbs.		120 lbs.		110 lbs.		100 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
									262	262	239	239	216	216	
13	330	330	309	309	287	287	265	265	248	248	227	227	207	207	2.797
14	313	313	293	293	274	274	254	254	230	230	211	211	192	192	3.244
15	292	292	274	274	255	255	237	237	215	215	197	197	179	179	3.724
16	274	274	257	257	239	239	222	222	201	201	185	185	168	168	4.237
17	258	258	242	242	225	225	209	209	189	189	174	174	158	158	4.783
18	243	243	228	228	213	213	198	198	179	179	164	164	149	149	5.363
19	231	231	216	216	202	202	187	187	169	169	155	155	141	141	5.975
20	219	219	205	205	192	192	178	178	161	161	148	148	134	134	6.621
21	209	209	196	196	182	182	169	169	153	153	141	141	128	128	7.299
22	199	199	187	187	174	174	162	162	146	146	134	134	122	122	8.011
23	191	191	179	179	167	167	155	155	140	140	128	128	117	117	8.756
24	183	183	171	171	160	160	148	148	134	134	123	123	112	112	9.534
25	175	175	164	164	153	153	142	142	129	129	118	118	107	107	10.345
26	169	169	158	158	147	147	137	137	124	123	114	113	103	102	11.189
27	162	162	152	152	142	142	132	132	119	117	109	107	99	97	12.066
28	156	156	147	147	137	137	127	127	115	112	105	102	96	93	12.977
29	151	151	142	142	132	132	123	123	111	107	102	98	93	89	13.920
30	146	145	137	136	128	127	119	118	107	102	98	94	89	85	14.897
31	141	139	132	131	124	122	115	113	104	98	95	90	87	81	15.906
32	137	134	128	125	120	117	111	109	101	94	92	86	84	78	16.949
33	133	129	124	121	116	112	108	104	98	90	89	82	81	75	18.025
34	129	124	121	116	113	108	105	100	95	86	87	79	79	72	19.134
35	125	119	117	112	109	104	102	97	92	83	84	76	77	69	20.276
36	122	115	114	108	106	100	99	93	89	80	82	73	75	66	21.451
37	118	111	111	104	104	97	96	90	87	77	80	70	73	64	22.659
38	115	107	108	100	101	93	94	87	85	74	78	68	71	61	23.901
39	112	103	105	97	98	90	91	84	83	71	76	65	69	59	25.175
40	110	100	103	93	96	87	89	81	81	69	74	63	67	57	26.483
41	107	96	100	90	93	84	87	78	79		72		65		27.823
42	104	93	98	87	91	81	85	75	77		70		64		29.197
43	102	90	95	84	89	79	83	73	75		69		62		30.604
44	100	87	93	82	87	76	81	71	73		67		61		32.044
45	97	84	91	79	85	74	79	68	72		66		60		33.517
46	95	82	89	77	83	71	77	66	70		64		58		35.023
47	93	79	87		82		76		69		63		57		36.563
48	91		86		80		74		67		62		56		38.135
49	89		84		78		73		66		60		55		39.741
50	88		82		77		71		64		59		54		41.379
51	86		81		75		70		63		58		53		43.051
52	84		79												44.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch
City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 242 24″x9¾″						CB 241 24″x8½″		CB 213 21″x13″						
	94 lbs.		85 lbs.		76 lbs.		70 lbs.		120 lbs.		112 lbs.		104 lbs.		
	Laterally						Laterally		Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	243	243	218	218	194	194	192	192							
10	240	240	217	217	194	194	174	174							1.655
11	218	218	197	197	177	177	158	158							2.003
12	200	200	181	181	162	162	145	145	227	227	211	211	195	195	2.383
13	185	185	167	167	149	149	134	134	223	223	208	208	193	193	2.797
14	171	171	155	155	139	139	124	124	207	207	194	194	180	180	3.244
15	160	160	145	145	129	129	116	116	194	194	181	181	168	168	3.724
16	150	150	136	136	121	121	109	109	181	181	169	169	157	157	4.237
17	141	141	128	128	114	114	102	102	171	171	159	159	148	148	4.783
18	133	133	121	121	108	108	96	96	161	161	151	151	140	140	5.363
19	126	126	114	114	102	102	91	90	153	153	143	143	132	132	5.975
20	120	120	109	109	97	97	87	84	145	145	136	136	126	126	6.621
21	114	114	103	103	92	92	83	79	138	138	129	129	120	120	7.299
22	109	107	99	97	88	86	79	74	132	132	123	123	114	114	8.011
23	104	101	94	91	84	82	76	70	126	126	118	118	109	109	8.756
24	100	96	90	86	81	77	72	66	121	121	113	113	105	105	9.534
25	96	91	87	82	78	73	69	62	116	116	108	108	101	101	10.345
26	92	86	83	78	75	69	67	59	112	112	104	104	97	97	11.189
27	89	82	80	74	72	66	64	56	108	108	100	100	93	93	12.066
28	86	78	78	70	69	63	62	53	104	103	97	96	90	89	12.977
29	83	74	75	67	67	60	60		100	98	93	92	87	85	13.920
30	80	71	72	64	65	57	58		97	94	90	88	84	82	14.897
31	77	68	70	61	63	54	56		94	90	87	84	81	78	15.906
32	75	64	68	58	61	52	54		91	87	85	81	79	75	16.949
33	73		66		59		53		88	83	82	78	76	72	18.025
34	71		64		57		51		85	80	80	75	74	69	19.134
35	69		62		55		50		83	77	77	72	72	67	20.276
36	67		60		54		48		81	74	75	69	70	64	21.451
37	65		59		52		47		78	71	73	67	68	62	22.659
38	63		57		51		46		76	69	71	64	66	60	23.901
39	62		56		50		45		74	66	69	62	64	57	25.175
40	60		54		49		43		73	64	68	60	63	55	26.483
41	59		53		47		42		71	62	66	58	61	53	27.823
42	57		52		46		41		69	60	65	56	60	52	29.197
43	56		50		45		40		68		63		58		30.604
44	55		49		44		39		66		62		57		32.044
45	53		48		43		39		65		60		56		33.517
46	52		47		42		38								35.023
47	51		46		41		37								36.563
48	50		45		40		36								38.135
49	49		44		40		35								39.741
50	48		43		39		35								41.379
51	47		43		38		34								43.051

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 212 21″x9″						CB 211 21″x8″								
	92 lbs.		86 lbs.		80 lbs.		70 lbs.		64 lbs.		60 lbs.		58 lbs.		
	Laterally						Laterally								
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	184	184	167	167	158	158	151	151							
9	213	213	199	199	184	184	172	172	157	157	147	147	143	143	1.341
10	210	210	196	196	182	182	155	155	142	142	132	132	128	128	1.655
11	191	191	178	178	166	166	141	141	129	129	120	120	117	117	2.003
12	175	175	163	163	152	152	129	129	118	118	110	110	107	107	2.383
13	161	161	151	151	140	140	119	119	109	109	102	102	99	99	2.797
14	150	150	140	140	130	130	111	111	101	101	95	95	92	92	3.244
15	140	140	131	131	122	122	103	103	94	94	88	88	86	86	3.724
16	131	131	122	122	114	114	97	97	89	89	83	83	80	80	4.237
17	123	123	115	115	107	107	91	91	83	83	78	78	75	75	4.783
18	116	116	109	109	101	101	86	85	79	77	74	72	71	70	5.363
19	110	110	103	103	96	96	82	79	75	72	70	67	68	65	5.975
20	105	103	98	96	91	90	77	74	71	67	66	63	64	61	6.621
21	100	97	93	91	87	84	74	69	67	63	63	59	61	57	7.299
22	95	91	89	85	83	79	70	65	64	59	60	55	58	54	8.011
23	91	86	85	80	79	75	67	61	62	56	58	52	56	50	8.756
24	87	81	82	76	76	71	65	58	59	53	55	49	53	48	9.534
25	84	77	78	72	73	67	62	54	57	50	53	46	51	45	10.345
26	81	73	75	68	70	63	60	51	55	47	51	44	49	42	11.189
27	78	69	73	65	68	60	57		52		49		48		12.066
28	75	66	70	61	65	57	55		51		47		46		12.977
29	72	63	68	58	63	54	53		49		46		44		13.920
30	70	60	65	56	61		52		47		44		43		14.897
31	68		63		59		50		46		43		41		15.906
32	65		61		57		48		44		41		40		16.949
33	64		59		55		47		43		40		39		18.025
34	62		58		54		46		42		39		38		19.134
35	60		56		52		44		40		38		37		20.276
36	58		54		51		43		39		37		36		21.451
37	57		53		49		42		38		36		35		22.659
38	55		52		48		41		37		35		34		23.901
39	54		50		47		40		36		34		33		25.175
40	52		49		46		39		35		33		32		26.483
41	51		48		44		38		35		32		31		27.823
42	50		47		43		37		34		32		31		29.197
43	49		46		42		36		33		31		30		30.604
44	48		45		41		35		32		30		29		32.044
45	47		44		41		34		31		29		28		33.517

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 183 18″x12″						CB 182 18″x8½″						
	100 lbs.		93 lbs.		86 lbs.		78 lbs.		72 lbs.		67 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
9							172	172					
10							171	171	158	158	146	146	1.341
							154	154	142	142	132	132	1.655
11	182	182	168	168	154	154	140	140	129	129	120	120	2.003
12	174	174	162	162	150	150	129	129	119	119	110	110	2.383
13	160	160	149	149	138	138	119	119	109	109	102	102	2.797
14	149	149	139	139	128	128	110	110	102	102	95	95	3.244
15	139	139	129	129	120	120	103	103	95	95	88	88	3.724
16	130	130	121	121	112	112	96	96	89	89	83	83	4.237
17	123	123	114	114	106	106	91	91	84	84	78	78	4.783
18	116	116	108	108	100	100	86	85	79	79	74	73	5.363
19	110	110	102	102	94	94	81	80	75	74	70	68	5.975
20	104	104	97	97	90	90	77	75	71	69	66	64	6.621
21	99	99	92	92	85	85	73	70	68	65	63	60	7.299
22	95	95	88	88	82	82	70	66	65	61	60	57	8.011
23	91	91	84	84	78	78	67	62	62	57	58	53	8.756
24	87	87	81	81	75	75	64	59	59	54	55	50	9.534
25	83	83	78	78	72	72	62	56	57	51	53	48	10.345
26	80	80	75	74	69	68	59	53	55	48	51	45	11.189
27	77	76	72	70	66	65	57	50	53	46	49	43	12.066
28	75	72	69	67	64	62	55	47	51	44	47	40	12.977
29	72	69	67	64	62	59	53		49		46		13.920
30	70	66	65	62	60	57	51		47		44		14.897
31	67	63	63	59	58	54	50		46		43		15.906
32	65	61	61	56	56	52	48		44		41		16.949
33	63	58	59	54	54	50	47		43		40		18.025
34	61	56	57	52	53	48	45		42		39		19.134
35	60	54	55	50	51	46	44		41		38		20.276
36	58	52	54	48	50	44	43		40		37		21.451
37	56		52		49		42		38		36		22.659
38	55		51		47		41		37		35		23.901
39	53		50		46		40		36		34		25.175

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 181 18″x7½″								CB 165 16″x14″						
	58 lbs.		52 lbs.		51 lbs.		47 lbs.		115 lbs.		107 lbs.		100 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	143	143	128	128	135	135	115	115							
8	140	140	126	126	120	120	114	114							1.059
9	125	125	112	112	107	107	101	101							1.341
10	112	112	101	101	96	96	91	91							1.655
11	102	102	92	92	87	87	83	83							2.003
12	94	94	84	84	80	80	76	76	173	173	160	160	148	148	2.383
13	86	86	77	77	74	74	70	70	168	168	157	157	146	146	2.797
14	80	80	72	72	68	68	65	65	156	156	145	145	136	136	3.244
15	75	75	67	67	64	64	61	61	146	146	136	136	127	127	3.724
16	70	70	63	63	60	60	57	57	137	137	127	127	119	119	4.237
17	66	65	59	58	56	55	54	52	129	129	120	120	112	112	4.783
18	62	60	56	54	53	51	51	49	122	122	113	113	106	106	5.363
19	59	56	53	50	50	48	48	45	115	115	107	107	100	100	5.975
20	56	52	50	47	48	45	46	42	109	109	102	102	95	95	6.621
21	53	49	48	44	46	42	43	40	104	104	97	97	91	91	7.299
22	51	46	46	41	44	39	41	37	99	99	93	93	86	86	8.011
23	49	43	44	39	42	37	40	35	95	95	89	89	83	83	8.756
24	47	41	42	36	40	35	38	33	91	91	85	85	79	79	9.534
25	45	38	40	34	38	33	36	31	88	88	81	81	76	76	10.345
26	43		39		37		35		84	84	78	78	73	73	11.189
27	42		37		36		34		81	81	75	75	70	70	12.066
28	40		36		34		33		78	78	73	73	68	68	12.977
29	39		35		33		31		75	75	70	70	66	66	13.920
30	37		34		32		30		73	73	68	67	63	63	14.897
31	36		32		31		29		71	70	66	65	61	60	15.906
32	35		31		30		28		68	67	64	62	59	58	16.949
33	34		31		29		28		66		62		58		18.025
34	33		30		28		27		64		60		56		19.134
35	32		29		27		26		63		58		54		20.276
36	31		28		27		25								21.451
37	30		27		26		25								22.659
38	30		27		25		24								23.901
39	29		26		25		23								25.175

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 164 16″x12″						CB 163 16″x8½″						
	90 lbs.		83 lbs.		76 lbs.		68 lbs.		63 lbs.		58 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
9							142.1	142.1	130.8	130.8	120.0	120.0	
10	160.8	160.8	147.7	147.7	134.1	134.1	134.9 121.4	134.9 121.4	125.0 112.5	125.0 112.5	115.1 103.5	115.1 103.5	1.341 1.655
11	152.3	152.3	140.5	140.5	128.6	128.6	110.4	110.4	102.3	102.3	94.1	94.1	2.003
12	139.6	139.6	128.8	128.8	117.9	117.9	101.2	101.2	93.8	93.8	86.3	86.5	2.383
13	128.9	128.9	118.9	118.9	108.8	108.8	93.4	93.4	86.5	86.5	79.7	79.7	2.797
14	119.7	119.7	110.4	110.4	101.1	101.1	86.7	86.7	80.4	80.4	74.0	74.0	3.244
15	111.7	111.7	103.0	103.0	94.3	94.3	81.0	81.0	75.0	75.0	69.0	69.0	3.724
16	104.7	104.7	96.6	96.6	88.4	88.4	75.9	75.9	70.3	70.3	64.7	64.7	4.237
17	98.6	98.6	90.9	90.9	83.2	83.2	71.4	71.4	66.2	66.2	60.9	60.9	4.783
18	93.1	93.1	85.9	85.9	78.6	78.6	67.5	67.3	62.5	62.3	57.5	57.3	5.363
19	88.2	88.2	81.3	81.3	74.5	74.5	63.9	62.9	59.2	58.2	54.5	53.5	5.975
20	83.8	83.8	77.3	77.3	70.8	70.8	60.7	58.9	56.3	54.5	51.8	50.1	6.621
21	79.8	79.8	73.6	73.6	67.4	67.4	57.8	55.3	53.6	51.1	49.3	47.0	7.299
22	76.2	76.2	70.2	70.2	64.3	64.3	55.2	52.0	51.1	48.1	47.1	44.2	8.011
23	72.8	72.8	67.2	67.2	61.5	61.5	52.8	49.0	48.9	45.2	45.0	41.7	8.756
24	69.8	69.8	64.4	64.4	59.0	59.0	50.6	46.2	46.9	42.8	43.1	39.3	9.534
25	67.0	67.0	61.8	61.8	56.6	56.6	48.6	43.7	45.0	40.4	41.4	37.2	10.345
26	64.4	63.9	59.4	58.9	54.4	53.9	46.7	41.4	43.3	38.3	39.8	35.2	11.189
27	62.1	60.9	57.2	56.1	52.4	51.4	45.0	39.2	41.7	36.3	38.4	33.3	12.066
28	59.8	58.2	55.2	53.6	50.5	49.0	43.4	37.2	40.2	34.4	37.0	31.6	12.977
29	57.8	55.6	53.3	51.2	48.8	46.8	41.9		38.8		35.7		13.920
30	55.9	53.2	51.5	49.0	47.2	44.8	40.5		37.5		34.5		14.897
31	54.0	50.9	49.9	46.9	45.6	42.9	39.2		36.3		33.4		15.906
32	52.4	48.8	48.3	45.0	44.2	41.1	38.0		35.2		32.4		16.949
33	50.8		46.8		42.9		36.8		34.1		31.4		18.025
34	49.3		45.5		41.6		35.7		33.1		30.5		19.134
35	47.9		44.2		40.4		34.7		32.1		29.6		20.276

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 162 16″x7″								CB 161 16″x6″				
	50 lbs.		45 lbs.		43 lbs.		40 lbs.		38 lbs.		35 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
					119.5	119.5							
6					116.9	116.9			100.6	100.6	92.4	92.4	0.596
7	117.7	117.7	105.2	105.2	100.2	100.2	92.8	92.8	90.4	90.4	83.3	83.3	0.811
8	109.3	109.3	98.4	98.4	87.7	87.7	87.4	87.4	79.1	79.1	72.9	72.9	1.059
9	97.1	97.1	87.4	87.4	77.9	77.9	77.7	77.7	70.3	70.3	64.8	64.8	1.341
10	87.4	87.4	78.7	78.7	70.1	70.1	69.9	69.9	63.3	63.3	58.3	58.3	1.655
11	79.5	79.5	71.5	71.5	63.8	63.8	63.6	63.6	57.5	57.5	53.0	53.0	2.003
12	72.8	72.8	65.6	65.6	58.4	58.4	58.3	58.3	52.7	52.7	48.6	48.6	2.383
13	67.2	67.2	60.5	60.5	53.9	53.9	53.8	53.8	48.7	48.3	44.9	44.4	2.797
14	62.4	62.4	56.2	56.2	50.1	50.1	50.0	50.0	45.2	43.9	41.7	40.4	3.244
15	58.3	58.0	52.5	52.2	46.8	46.6	46.6	46.3	42.2	40.1	38.9	36.9	3.724
16	54.6	53.5	49.2	48.1	43.8	42.9	43.7	42.7	39.6	36.8	36.5	33.9	4.237
17	51.4	49.4	46.3	44.4	41.3	39.7	41.1	39.4	37.2	33.9	34.3	31.2	4.783
18	48.6	45.9	43.7	41.2	39.0	36.8	38.9	36.6	35.2	31.3	32.4	28.8	5.363
19	46.0	42.7	41.4	38.4	36.9	34.3	36.8	34.0	33.3	29.0	30.7	26.7	5.975
20	43.7	39.8	39.3	35.8	35.1	32.0	35.0	31.7	31.6	27.0	29.2	24.8	6.621
21	41.6	37.2	37.5	33.4	33.4	29.9	33.3	29.6	30.1		27.8		7.299
22	39.7	34.8	35.8	31.3	31.9	28.0	31.8	27.8	28.8		26.5		8.011
23	38.0	32.7	34.2	29.3	30.5	26.2	30.4	26.0	27.5		25.4		8.756
24	36.4		32.8		29.2		29.1		26.4		24.3		9.534
25	35.0		31.5		28.1		28.0		25.3		23.3		10.345
26	33.6		30.3		27.0		26.9		24.3		22.4		11.189
27	32.4		29.1		26.0		25.9		23.4		21.6		12.066
28	31.2		28.1		25.0		25.0		22.6		20.8		12.977
29	30.1		27.1		24.2		24.1		21.8		20.1		13.920
30	29.1		26.2		23.4		23.3		21.1		19.4		14.897
31	28.2		25.4		22.6		22.6		20.4		18.8		15.906
32	27.3		24.6		21.9		21.9		19.8		18.2		16.949
33	26.5		23.8		21.3		21.2		19.2		17.7		18.025
34	25.7		23.1		20.6		20.6		18.6		17.2		19.134
35	25.0		22.5				20.0		18.1				20.276

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 145 14″x12″						CB 144 14″x10″						
	105 lbs.		95 lbs.		85 lbs.		75 lbs.		68 lbs.		61 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
10							134.6	134.6	121.0	121.0	107.7	107.7	
							122.2	122.2	110.7	110.7	99.3	99.3	1.655
11	154.0	154.0	137.6	137.6	121.8	121.8	111.0	111.0	100.6	100.6	90.3	90.3	2.003
12	144.7	144.7	130.8	130.8	117.0	117.0	101.8	101.8	92.2	92.2	82.8	82.8	2.383
13	133.6	133.6	120.8	120.8	108.0	108.0	94.0	94.0	85.2	85.2	76.4	76.4	2.797
14	124.0	124.0	112.1	112.1	100.3	100.3	87.3	87.3	79.1	79.1	71.0	71.0	3.244
15	115.8	115.8	104.7	104.7	93.6	93.6	81.4	81.4	73.8	73.8	66.2	66.2	3.724
16	108.5	108.5	98.1	98.1	87.7	87.7	76.3	76.3	69.2	69.2	62.1	62.1	4.237
17	102.1	102.1	92.4	92.4	82.6	82.6	71.9	71.9	65.1	65.1	58.4	58.4	4.783
18	96.5	96.5	87.2	87.2	78.0	78.0	67.9	67.9	61.5	61.5	55.2	55.2	5.363
19	91.4	91.4	82.6	82.6	73.9	73.9	64.3	64.3	58.3	58.3	52.3	52.3	5.975
20	86.8	86.8	78.5	78.5	70.2	70.2	61.1	61.1	55.4	55.4	49.7	49.7	6.621
21	82.7	82.7	74.8	74.8	66.9	66.9	58.2	58.2	52.7	52.7	47.3	47.2	7.299
22	78.9	78.9	71.4	71.4	63.8	63.8	55.5	54.9	50.3	49.7	45.2	44.5	8.011
23	75.5	75.5	68.3	68.3	61.0	61.0	53.1	51.9	48.1	46.9	43.2	42.1	8.756
24	72.4	72.4	65.4	65.4	58.5	58.5	50.9	49.1	46.1	44.4	41.4	39.8	9.534
25	69.5	69.5	62.8	62.8	56.2	56.2	48.9	46.5	44.3	42.1	39.7	37.7	10.345
26	66.8	66.3	60.4	59.9	54.0	53.5	47.0	44.2	42.6	40.0	38.2	35.8	11.189
27	64.3	63.2	58.1	57.1	52.0	51.0	45.2	42.0	41.0	38.0	36.8	34.1	12.066
28	62.0	60.3	56.1	54.5	50.1	48.6	43.6	40.0	39.5	36.2	35.5	32.4	12.977
29	59.9		54.1		48.4		42.1		38.2		34.3		13.920
30	57.9		52.3		46.8		40.7		36.9		33.1		14.897
31	56.0		50.6		45.3		39.4		35.7		32.0		15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 143 14″x8″						CB 142 14″x6¾″				
	58 lbs.		53 lbs.		48 lbs.		42 lbs.		39 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
7	117.6	117.6	106.8	106.8	96.0	96.0	97.4 92.4	97.4 92.4	90.1 85.7	90.1 85.7	0.811
8	114.1	114.1	104.3	104.3	94.5	94.5	80.8	80.8	75.0	75.0	1.059
9	101.4	101.4	92.7	92.7	84.0	84.0	71.8	71.8	66.7	66.7	1.341
10	91.3	91.3	83.5	83.5	75.6	75.6	64.6	64.6	60.0	60.0	1.655
11	83.0	83.0	75.9	75.9	68.7	68.7	58.8	58.8	54.6	54.6	2.003
12	76.1	76.1	69.6	69.6	63.0	63.0	53.9	53.9	50.0	50.0	2.383
13	70.2	70.2	64.2	64.2	58.1	58.1	49.7	49.7	46.2	46.2	2.797
14	65.2	65.2	59.6	59.6	54.0	54.0	46.2	46.2	42.9	42.9	3.244
15	60.9	60.9	55.6	55.6	50.4	50.4	43.1	42.5	40.0	39.4	3.724
16	57.1	57.1	52.2	52.2	47.2	47.2	40.4	39.1	37.5	36.3	4.237
17	53.7	53.5	49.1	48.9	44.5	44.2	38.0	36.2	35.3	33.5	4.783
18	50.7	49.8	46.4	45.5	42.0	41.2	35.9	33.5	33.3	31.1	5.363
19	48.0	46.5	43.9	42.4	39.8	38.4	34.0	31.2	31.6	28.9	5.975
20	45.6	43.5	41.7	39.7	37.8	35.9	32.3	29.0	30.0	26.9	6.621
21	43.5	40.8	39.7	37.2	36.0	33.7	30.8	27.1	28.6	25.1	7.299
22	41.5	38.3	37.9	35.0	34.4	31.6	29.4	25.4	27.3	23.5	8.011
23	39.7	36.0	36.3	32.9	32.9	29.7	28.1		26.1		8.756
24	38.0	34.0	34.8	31.0	31.5	28.0	26.9		25.0		9.534
25	36.5	32.1	33.4	29.3	30.2	26.5	25.9		24.0		10.345
26	35.1	30.3	32.1	27.7	29.1	25.0	24.9		23.1		11.189
27	33.8		30.9		28.0		23.9		22.2		12.066
28	32.6		29.8		27.0		23.1		21.4		12.977
29	31.5		28.8		26.1		22.3		20.7		13.920
30	30.4		27.8		25.2		21.5		20.0		14.897
31	29.4		26.9		24.4		20.9		19.4		15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 142 14″x6¾″						CB 141 14″x6″		
	38 lbs.		36 lbs.		33 lbs.		30 lbs.		
	Laterally						Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	105.0	105.0					75.4	75.4	
6	90.8	90.8	82.8	82.8	75.6	75.6	74.3	74.3	0.596
7	77.8	77.8	79.1	79.1	72.6	72.6	63.7	63.7	0.811
8	68.1	68.1	69.3	69.3	63.5	63.5	55.8	55.8	1.059
9	60.5	60.5	61.6	61.6	56.5	56.5	49.6	49.6	1.341
10	54.5	54.5	55.4	55.4	50.8	50.8	44.6	44.6	1.655
11	49.5	49.5	50.4	50.4	46.2	46.2	40.5	40.5	2.003
12	45.4	45.4	46.2	46.2	42.3	42.3	37.2	37.2	2.383
13	41.9	41.9	42.6	42.6	39.1	39.1	34.3	34.0	2.797
14	38.9	38.9	39.6	39.6	36.3	36.3	31.9	30.9	3.244
15	36.3	35.9	36.9	36.4	33.9	33.3	29.7	28.2	3.724
16	34.0	33.0	34.6	33.5	31.8	30.7	27.9	25.9	4.237
17	32.0	30.5	32.6	30.9	29.9	28.3	26.2	23.9	4.783
18	30.3	28.3	30.8	28.7	28.2	26.3	24.8	22.1	5.363
19	28.7	26.3	29.2	26.6	26.7	24.4	23.5	20.4	5.975
20	27.2	24.5	27.7	24.8	25.4	22.7	22.3	19.0	6.621
21	25.9	22.9	26.4	23.2	24.2	21.2	21.2		7.299
22	24.8	21.4	25.2	21.7	23.1	19.8	20.3		8.011
23	23.7		24.1		22.1		19.4		8.756
24	22.7		23.1		21.2		18.6		9.534
25	21.8		22.2		20.3		17.8		10.345
26	21.0		21.3		19.5		17.2		11.189
27	20.2		20.5		18.8		16.5		12.066
28	19.5		19.8		18.1		15.9		12.977
29	18.8		19.1		17.5		15.4		13.920
30	18.2		18.5		16.9		14.9		14.897
31	17.6		17.9		16.4				15.906

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 124 12″x10″								CB 123 12″x8″				
	100 lbs.		91 lbs.		83 lbs.		75 lbs.		50 lbs.		45 lbs.		
	Laterally								Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
5	269.0 234.3	269.0 234.3	216.0	216.0									0.414
6	195.3	195.3	185.8	185.8	169.0	169.0							0.596
7	167.4	167.4	159.3	159.3	152.1	152.1			88.5	88.5	79.1	79.1	0.811
8	146.4	146.4	139.4	139.4	133.1	133.1	121.9	121.9	87.1	87.1	78.5	78.5	1.059
9	130.2	130.2	123.9	123.9	118.3	118.3	112.7	112.7	77.5	77.5	69.7	69.7	1.341
10	117.2	117.2	111.5	111.5	106.5	106.5	101.5	101.5	69.7	69.7	62.8	62.8	1.655
11	106.5	106.5	101.4	101.4	96.8	96.8	92.2	92.2	63.4	63.4	57.1	57.1	2.003
12	97.6	97.6	92.9	92.9	88.7	88.7	84.5	84.5	58.1	58.1	52.3	52.3	2.383
13	90.1	90.1	85.8	85.8	81.9	81.9	78.0	78.0	53.6	53.6	48.3	48.3	2.797
14	83.7	83.7	79.6	79.6	76.1	76.1	72.5	72.5	49.8	49.8	44.8	44.8	3.244
15	78.1	78.1	74.3	74.3	71.0	71.0	67.6	67.6	46.5	46.5	41.8	41.8	3.724
16	73.2	73.2	69.7	69.7	66.5	66.5	63.4	63.4	43.6	43.6	39.2	39.2	4.237
17	68.9	68.9	65.6	65.6	62.6	62.6	59.7	59.7	41.0	40.9	36.9	36.8	4.783
18	65.1	65.1	61.9	61.9	59.2	59.2	56.4	56.4	38.7	38.0	34.9	34.2	5.363
19	61.7	61.7	58.7	58.7	56.0	56.0	53.4	53.4	36.7	35.5	33.0	31.9	5.975
20	58.6	58.6	55.7	55.7	53.2	53.2	50.7	50.7	34.9	33.2	31.4	29.9	6.621
21	55.8	55.8	53.1	53.1	50.7	50.7	48.3	48.2	33.2	31.1	29.9	28.0	7.299
22	53.3	53.3	50.7	50.5	48.4	48.0	46.1	45.5	31.7	29.2	28.5	26.3	8.011
23	50.9	50.4	48.5	47.7	46.3	45.3	44.1	43.0	30.3	27.5	27.3	24.7	8.756
24	48.8	47.8	46.5	45.2	44.4	42.9	42.3	36.4	29.0	25.9	26.2	23.3	9.534
25	46.9		44.6		42.6		40.6		27.9		25.1		10.345
26	45.1		42.9		41.0		39.0		26.8		24.1		11.189
27	43.4		41.3		39.4		37.6		25.8		23.2		12.066

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 123 12″x8″		CB 122 12″x6½″								CB 121 12″x6″		
	40 lbs.		36 lbs.		34 lbs.		32 lbs.		28 lbs.		25 lbs.		
	Laterally		Laterally								Laterally		
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
5					90.2 / 84.5	90.2 / 84.5					57.2	57.2	0.414
6			75.4	75.4	70.4	70.4	66.4	66.4	57.6	57.6	54.6	54.6	0.596
7			69.8	69.8	60.4	60.4	62.0	62.0	53.2	53.2	46.8	46.8	0.811
8	69.6	69.6	61.0	61.0	52.8	52.8	54.2	54.2	47.4	47.4	40.9	40.9	1.059
9	62.0	62.0	54.3	54.3	46.9	46.9	48.2	48.2	42.2	42.2	36.4	36.4	1.341
10	55.8	55.8	48.8	48.8	42.3	42.3	43.4	43.4	37.9	37.9	32.7	32.7	1.655
11	50.7	50.7	44.4	44.4	38.4	38.4	39.4	39.4	34.5	34.5	29.8	29.8	2.003
12	46.5	46.5	40.7	40.7	35.2	35.2	36.1	36.1	31.6	31.6	27.3	27.3	2.383
13	42.9	42.9	37.6	37.6	32.5	32.5	33.4	33.4	29.2	29.2	25.2	24.9	2.797
14	39.8	39.8	34.9	34.7	30.2	30.1	31.0	30.8	27.1	26.9	23.4	22.7	3.244
15	37.2	37.2	32.6	31.8	28.2	27.6	28.9	28.2	25.3	24.6	21.8	20.7	3.724
16	34.9	34.9	30.5	29.3	26.4	25.4	27.1	25.9	23.7	22.6	20.5	19.0	4.237
17	32.8	32.6	28.7	27.0	24.9	23.4	25.5	23.9	22.3	20.9	19.3	17.5	4.783
18	31.0	30.4	27.1	25.0	23.5	21.7	24.1	22.2	21.1	19.3	18.2	16.2	5.363
19	29.4	28.3	25.7	23.2	22.2	20.2	22.8	20.6	20.0	18.0	17.2	15.0	5.975
20	27.9	26.5	24.4	21.6	21.1	18.8	21.7	19.1	19.0	16.7	16.4	13.9	6.621
21	26.6	24.8	23.3	20.2	20.1	17.5	20.7	17.8	18.1	15.6	15.6		7.299
22	25.4	23.3	22.2		19.2	16.4	19.7		17.2		14.9		8.011
23	24.2	21.9	21.2		18.4		18.9		16.5		14.2		8.756
24	23.2	20.7	20.3		17.6		18.1		15.8		13.6		9.534
25	22.3		19.5		16.9		17.3		15.2		13.1		10.345
26	21.5		18.8		16.3		16.7		14.6		12.6		11.189
27	20.7		18.1		15.6		16.1		14.1				12.066

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 103 10″x9″						CB 102 10″x8″						
	63 lbs.		56 lbs.		49 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
4	157.4	157.4					128.8 101.5	128.8 101.5	93.4	93.4			0.265
5	128.2	128.2	116.2	116.2			81.2	81.2	74.9	74.9	64.0	64.0	0.414
6	106.8	106.8	100.7	100.7			67.7	67.7	62.4	62.4	58.1	58.1	0.596
7	91.5	91.5	86.3	86.3	75.0	75.0	58.0	58.0	53.5	53.5	49.8	49.8	0.811
8	80.1	80.1	75.5	75.5	70.9	70.9	50.8	50.8	46.8	46.8	43.6	43.6	1.059
9	71.2	71.2	67.1	67.1	63.1	63.1	45.1	45.1	41.6	41.6	38.7	38.7	1.341
10	64.1	64.1	60.4	60.4	56.8	56.8	40.6	40.6	37.5	37.5	34.8	34.8	1.655
11	58.3	58.3	54.9	54.9	51.6	51.6	36.9	36.9	34.1	34.1	31.7	31.7	2.003
12	53.4	53.4	50.3	50.3	47.3	47.3	33.8	33.8	31.2	31.2	29.0	29.0	2.383
13	49.3	49.3	46.5	46.5	43.7	43.7	31.2	31.2	28.8	28.8	26.8	26.8	2.797
14	45.8	45.8	43.2	43.2	40.5	40.5	29.0	29.0	26.8	26.8	24.9	24.9	3.244
15	42.7	42.7	40.3	40.3	37.8	37.8	27.1	27.1	25.0	25.0	23.2	23.2	3.724
16	40.0	40.0	37.8	37.8	35.5	35.5	25.4	25.4	23.4	23.4	21.8	21.8	4.237
17	37.7	37.7	35.5	35.5	33.4	33.4	23.9	23.9	22.0	22.0	20.5	20.4	4.783
18	35.6	35.6	33.6	33.6	31.5	31.5	22.6	22.3	20.8	20.5	19.4	19.0	5.363
19	33.7	33.7	31.8	31.8	29.9	29.8	21.4	20.9	19.7	19.1	18.3	17.7	5.975
20	32.0	31.9	30.2	29.9	28.4	27.9	20.3	19.5	18.7	17.9	17.4	16.6	6.621
21	30.5		28.8		27.0		19.3		17.8		16.6		7.299
22	29.1		27.5		25.8		18.5		17.0		15.8		8.011
23	27.9		26.3		24.7		17.7		16.3		15.2		8.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Continued

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot														Coefficient of Deflection
	CB 101 10″x6″								CB 93 9″x9″						
	30 lbs.		26 lbs.		23 lbs.		21 lbs.		48 lbs.		43 lbs.		38 lbs.		
	Laterally								Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	61.0	61.0	52.3	52.3	46.0	46.0	45.6	45.6							
6	56.7	56.7	49.1	49.1	43.4	43.4	38.6	38.6	73.6	73.6					0.596
7	48.6	48.6	42.1	42.1	37.2	37.2	33.1	33.1	72.9	72.9	65.1	65.1	56.9	56.9	0.811
8	42.6	42.6	36.8	36.8	32.6	32.6	29.0	29.0	63.8	63.8	57.2	57.2	50.5	50.5	1.059
9	37.8	37.8	32.7	32.7	29.0	29.0	25.8	25.8	56.7	56.7	50.8	50.8	44.9	44.9	1.341
10	34.0	34.0	29.5	29.5	26.1	26.1	23.2	23.2	51.0	51.0	45.7	45.7	40.4	40.4	1.655
11	30.9	30.9	26.8	26.8	23.7	23.7	21.1	21.1	46.4	46.4	41.6	41.6	36.7	36.7	2.003
12	28.4	28.4	24.6	24.6	21.7	21.7	19.3	19.3	42.5	42.5	38.1	38.1	33.7	33.7	2.383
13	26.2	26.0	22.7	22.5	20.0	19.8	17.8	17.7	39.3	39.3	35.2	35.2	31.1	31.1	2.797
14	24.3	23.7	21.1	20.4	18.6	18.1	16.6	16.1	36.5	36.5	32.7	32.7	28.9	28.9	3.244
15	22.7	21.6	19.6	18.7	17.4	16.5	15.5	14.7	34.0	34.0	30.5	30.5	26.9	26.9	3.724
16	21.3	19.9	18.4	17.2	16.3	15.1	14.5	13.5	31.9	31.9	28.6	28.6	25.2	25.2	4.237
17	20.0	18.3	17.3	15.8	15.3	14.0	13.6	12.4	30.0	30.0	26.9	26.9	23.8	23.8	4.783
18	18.9	16.9	16.4	14.6	14.5	12.9	12.9	11.5	28.4	28.4	25.4	25.4	22.4	22.4	5.363
19	17.9	15.7	15.5	13.5	13.7	11.9	12.2	10.6	26.9		24.1		21.3		5.975
20	17.0	14.5	14.7	12.6	13.0	11.1	11.6		25.5		22.9		20.2		6.621
21	16.2		14.0		12.4		11.0		24.3		21.8		19.2		7.299
22	15.5		13.4		11.8		10.5								8.011
23	14.8		12.8		11.3										8.756

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

CARNEGIE BEAM SECTIONS—Concluded

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch
City of Chicago Code

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 92 9″x6½″						CB 83 8″x8″						
	35 lbs.		32 lbs.		29 lbs.		42 lbs.		36 lbs.		31 lbs.		
	Laterally						Laterally						
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
	61.6	61.6	55.9	55.9	50.2	50.2							
6	60.1	60.1	54.9	54.9	49.8	49.8	65.2	65.2	55.1	55.1	46.7	46.7	0.596
7	51.5	51.5	47.1	47.1	42.7	42.7	57.0	57.0	48.8	48.8	41.9	41.9	0.811
8	45.1	45.1	41.2	41.2	37.3	37.3	49.8	49.8	42.7	42.7	36.7	36.7	1.059
9	40.1	40.1	36.6	36.6	33.2	33.2	44.3	44.3	38.0	38.0	32.6	32.6	1.341
10	36.1	36.1	33.0	33.0	29.9	29.9	39.9	39.9	34.2	34.2	29.4	29.4	1.655
11	32.8	32.8	30.0	30.0	27.2	27.2	36.2	36.2	31.1	31.1	26.7	26.7	2.003
12	30.1	30.1	27.5	27.5	24.9	24.9	33.2	33.2	28.5	28.5	24.5	24.5	2.383
13	27.8	27.8	25.4	25.4	23.0	23.0	30.7	30.7	26.3	26.3	22.6	22.6	2.797
14	25.8	25.6	23.5	23.4	21.3	21.2	28.5	28.5	24.4	24.4	21.0	21.0	3.244
15	24.1	23.5	22.0	21.4	19.9	19.4	26.6	26.6	22.8	22.8	19.6	19.6	3.724
16	22.5	21.6	20.6	19.7	18.7	17.8	24.9	24.9	21.4	21.4	18.3	18.3	4.237
17	21.2	19.9	19.4	18.2	17.6	16.4	23.5		20.1		17.3		4.783
18	20.0	18.5	18.5	17.0	16.6	15.2	22.2		19.0		16.3		5.363
19	19.0		17.3		15.7		21.0		18.0		15.5		5.975
20	18.0		16.5		14.9								6.621
21	17.2		15.7		14.2								7.299

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 82 8″x6½″						*B 40 9″x5¼″				
	30 lbs.		27 lbs.		24 lbs.		25 lbs.		21 lbs.		
	Laterally						Laterally				
	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	Fixed	Free	
3							68.4	68.4			0.149
4							56.6	56.6	45.0	45.0	0.265
5	48.8	48.8	43.4	43.4	38.2	38.2	45.3	45.3	41.5	41.5	0.414
6	46.8	46.8	42.1	42.1	37.4	37.4	37.7	37.7	34.6	34.6	0.596
7	40.1	40.1	36.1	36.1	32.1	32.1	32.3	32.3	29.7	29.7	0.811
8	35.1	35.1	31.6	31.6	28.1	28.1	28.3	28.3	26.0	26.0	1.059
9	31.2	31.2	28.1	28.1	25.0	25.0	25.1	25.1	23.1	23.1	1.341
10	28.1	28.1	25.3	25.3	22.5	22.5	22.6	22.6	20.8	20.8	1.655
11	25.5	25.5	23.0	23.0	20.4	20.4	20.6	20.6	18.9	18.8	2.003
12	23.4	23.4	21.0	21.0	18.7	18.7	18.9	18.5	17.3	16.9	2.383
13	21.6	21.6	19.4	19.4	17.3	17.3	17.4	16.7	16.0	15.2	2.797
14	20.1	19.9	18.0	17.9	16.0	15.9	16.2	15.2	14.8	13.8	3.244
15	18.7	18.3	16.8	16.4	15.0	15.6	15.1	13.8	13.8	12.6	3.724
16	17.5	16.8	15.8	15.1	14.0	13.4	14.1	12.6	13.0	11.5	4.237
17	16.5		14.9		13.2		13.3	11.6	12.2	10.5	4.783
18	15.6		14.0		12.5		12.6		11.5		5.363
19	14.8		13.3		11.8		11.9		10.9		5.975
20							11.3		10.4		6.621
21							10.8		9.9		7.299

*Standard Mill Section.
Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

STANDARD MILL SECTIONS

Allowable Uniform Loads in Thousands of Pounds

Maximum Bending Stress, 16,000 Pounds per Square Inch

City of Chicago Code

Span in Feet	B 39 8″x5″ 21 lbs. Laterally Fixed	B 39 8″x5″ 21 lbs. Laterally Free	B 39 8″x5″ 18 lbs. Laterally Fixed	B 39 8″x5″ 18 lbs. Laterally Free	H 4 8″x8″ 37.7 lbs. Laterally Fixed	H 4 8″x8″ 37.7 lbs. Laterally Free	H 4 8″x8″ 34.3 lbs. Laterally Fixed	H 4 8″x8″ 34.3 lbs. Laterally Free	H 4 8″x8″ 32.6 lbs. Laterally Fixed	H 4 8″x8″ 32.6 lbs. Laterally Free	Coefficient of Deflection
	57.6	57.6									
3	56.4	56.4	40.0	40.0							
4	42.3	42.3	39.2	39.2	80.0	80.0					0.149
5	33.8	33.8	31.3	31.3	64.4	64.4	60.0	60.0			0.265
											0.414
6	28.2	28.2	26.1	26.1	53.7	53.7	51.4	51.4	50.1	50.1	0.596
7	24.2	24.2	22.4	22.4	46.0	46.0	44.0	44.0	43.0	43.0	0.811
8	21.1	21.1	19.6	19.6	40.3	40.3	38.5	38.5	37.6	37.6	1.059
9	18.8	18.8	17.4	17.4	35.8	35.8	34.3	34.3	33.4	33.4	1.341
10	16.9	16.9	15.7	15.7	32.2	32.2	30.8	30.8	30.1	30.1	1.655
11	15.4	15.3	14.2	14.0	29.3	29.3	28.0	28.0	27.3	27.3	2.003
12	14.1	13.7	13.1	12.6	26.8	26.8	25.7	25.7	25.1	25.1	2.383
13	13.0	12.3	12.1	11.3	24.8	24.8	23.7	23.7	23.1	23.1	2.797
14	12.1	11.1	11.2	10.2	23.0	23.0	22.0	22.0	21.5	21.5	3.244
15	11.3	10.1	10.4	9.3	21.4	21.4	20.6	20.6	20.1	20.1	3.724
16	10.6	9.2	9.8	8.5	20.1	20.1	19.3	19.3	18.8	18.8	4.237
17	10.0		9.2		19.0		18.1		17.7		4.783
18	9.4		8.7		17.9		17.1		16.7		5.363
19	8.1		7.5		15.3		14.7		14.3		5.975

Span in Feet	H 3-A 6″x6″ 27.5 lbs. Laterally Fixed	H 3-A 6″x6″ 27.5 lbs. Laterally Free	H 3-A 6″x6″ 25 lbs. Laterally Fixed	H 3-A 6″x6″ 25 lbs. Laterally Free	H 3 6″x6″ 22.5 lbs. Laterally Fixed	H 3 6″x6″ 22.5 lbs. Laterally Free	H 3 6″x6″ 20 lbs. Laterally Fixed	H 3 6″x6″ 20 lbs. Laterally Free	H 2 5″x5″ 18.9 lbs. Laterally Fixed	H 2 5″x5″ 18.9 lbs. Laterally Free	H 1 4″x4″ 13.8 lbs. Laterally Fixed	H 1 4″x4″ 13.8 lbs. Laterally Free	Coefficient of Deflection
	52.6	52.6			45.0	45.0			31.3	31.3	25.0 18.8	25.0 18.8	
3	43.8	43.8	37.6	37.6	36.5	36.5	30.0	30.0	25.3	25.3	14.1	14.1	0.149
4	35.0	35.0	33.4	33.4	29.2	29.2	27.6	27.6	20.3	20.3	11.3	11.3	0.265
5													0.414
6	29.2	29.2	27.9	27.9	24.3	24.3	23.0	23.0	16.9	16.9	9.4	9.4	0.596
7	25.0	25.0	23.9	23.9	20.8	20.8	19.7	19.7	14.5	14.5	8.1	8.1	0.811
8	21.9	21.9	20.9	20.9	18.2	18.2	17.2	17.2	12.7	12.7	7.1	7.1	1.059
9	19.5	19.5	18.6	18.6	16.2	16.2	15.3	15.3	11.3	11.3	6.3		1.341
10	17.5	17.5	16.7	16.7	14.6	14.6	13.8	13.8	10.1	10.1	5.7		1.655
11	15.9	15.9	15.2	15.2	13.3	13.3	12.5	12.5	9.2		5.1		2.003
12	14.6	14.6	13.9	13.9	12.2	12.2	11.5	11.5	8.4				2.383
13	13.5		12.9		11.2		10.6		7.8				2.797
14	12.5		11.9		10.4		9.9						3.244
15	11.7		11.1		9.7		9.2						3.724

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
For maximum safe loads, see tables of Maximum Bending Moments and Web Resistances.

COLUMNS AND STRUTS

A compression member, subjected to longitudinal pressure, is shortened by the compression and also tends to deflect laterally, due to the fact that the load cannot be applied coincident with the longitudinal axis and that the material is not perfectly homogeneous. This flexure occurs generally in the direction of the least resisting moment of the section; the load which will cause a column to fail decreases in the ratio of length to least lateral resistance of the section, the ultimate failure being the result of combined stresses due to compression, transverse shear and flexure.

Column Formulas. Under ideal conditions, when it can be assumed that the load is applied axially and that the material is perfectly homogeneous, the resistance of the column would equal its resistance to compressive forces up to the elastic limit, and there would not be any flexure; if, however, a deflection be imparted to the column by a lateral force, the column would ultimately fail by bending.

Euler's Formula, $P = k \frac{\pi^2 E I}{l^2}$ or $\frac{P}{A} = k \frac{\pi^2 E}{(l/r)^2}$, is based upon the foregoing theory, and gives results close to the ultimate strength found for long and slender struts, when k is a constant varying with the condition of end bearing, (k=4 for columns fixed both ends). For shorter and heavier columns, or for lower ratios of l/r the results do not correspond with actual tests.

Rankine's Formula, $P = \frac{Af}{1 + c\,(l/r)^2}$ or $\frac{P}{A} = \frac{f}{1 + c\,(l/r)^2}$, represents the type of formula now in general use and the various formulas for proportioning columns which are based upon this general formula agree with actual tests within certain limits. In this formula a certain compressive unit stress for direct crushing is assumed and reduced in ratio of length of column and least radius of gyration, l/r; value of c is an empirical factor, varying with the resistance of the material and with conditions of end bearing.

Straight Line Formulas. In practice, compression members of a greater ratio of slenderness, l/r, than 120 are rarely used, and within this limit the curve can be represented by a straight line, the general formula assuming the simpler form: $\frac{P}{A} = f - c\,(\frac{l}{r})$.

Compression formulas determining the resistance of webs in rolled beams or riveted girders against buckling, or the necessary reduction of safe loads due to lateral deflection of unbraced beams, are likewise based on one or the other type of column formulas.

Ratio of Slenderness. l/r is ratio of the unsupported length of a compression member to its radius of gyration, generally the least radius, excepting when the unsupported length is rigidly braced to prevent deflection in the direction which corresponds to the least radius of gyration. It is, therefore, necessary to determine the radii of gyration and to use the proper ratio of slenderness in every case.

Usual practice limits the maximum ratio of l/r for main members under permanent stress, permitting a higher ratio for secondary members under temporary stress, as in wind bracing.

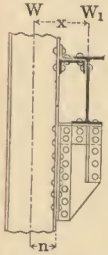
Compressive Unit Stresses. The tables of allowable loads of column sections have been computed in accordance with the formula for steel columns of the building codes of New York and of Chicago.:

$$f = 16{,}000 - 70\ l/r$$

NEW YORK: { Maximum unit stress at l/r=0 : 16,000 lb. per sq. inch
Maximum l/r: Primary and Secondary members=120.

CHICAGO: { Maximum unit stress l/r=28.57 : 14,000 lb. per sq. inch.
Max. l/r: Primary members=120; Secondary members=150

Combined Bending and Compression Stresses. Generally the loads are concentric and equally distributed over the cross section of the column or balanced on opposite sides thereof. In the case of beams carried on brackets or other forms of eccentric loading, bending stresses are produced which should be taken into consideration and the column sections so proportioned that the combined stresses do not exceed the allowable axial compressive stress.



W =Concentric load. W_1=Eccentric load.
M =Bending moment due to eccentric load=$W_1 x$.
I =Moment of inertia in direction of bending.
n =Distance from extreme fiber in direction of bending.
A =Area of column section, in square inches.
f =Allowable axial unit stress; f should be equal to or greater than $\frac{W + W_1}{A} + \frac{Mn}{I}$, the fiber stresses due to compression and bending respectively.

EXAMPLE:—Required a beam column, 23 feet long, to sustain a balanced load of 200,000 pounds and an eccentric load of 28,000 pounds applied 17 inches from the column center on axis 1-1.

Assume Carnegie Beam Section CB-165, 16″x14″, 100 lb.

$A = 29.41 \quad I_{1\text{-}1} = 1426.8 \quad r_{2\text{-}2} = 3.53 \quad l/r = 23 \times 12 \div 3.53 = 78.2$

Actual fiber stress $= \frac{200{,}000+28{,}000}{29.41} + \frac{28{,}000 \times 17 \times 8}{1426.8} = 10{,}424$ pounds.

This stress is within the limits of the allowable fiber stress for ratio of l/r = 78.2, 10,526 pounds, obtained from the column formula.

Allowable Unit Stresses in Pounds per Square Inch

by Compression Formula of

New York Building Law: $16000 - 70 \frac{l}{r}$

The following tables give the unit stresses for ratios of l/r in intervals of 5/10. Intermediate values may be found by interpolation from the figures given for the tenth units of l/r by adding or deducting from the nearest tabulated figure the corresponding multiple.

Example: Unit stress for l/r=38.2 and l/r=112.8

l/r= 38.2 13305 +21 or 13340—14=13326

l/r=112.8 8090 +14 or 8125—21= 8104

MAIN AND SECONDARY MEMBERS—Ratios of l/r up to 120

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
0	16000		15	14950		30	13900		45	12850	
.5	15965		.5	14915		.5	13865		.5	12815	
1	15930		16	14880		31	13830		46	12780	
.5	15895		.5	14845		.5	13795		.5	12745	
2	15860		17	14810		32	13760		47	12710	
.5	15825		.5	14775		.5	13725		.5	12675	
3	15790		18	14740		33	13690		48	12640	
.5	15755		.5	14705		.5	13655		.5	12605	
4	15720		19	14670		34	13620		49	12570	
.5	15685		.5	14635		.5	13585		.5	12535	
5	15650		20	14600		35	13550		50	12500	
.5	15615		.5	14565		.5	13515		.5	12465	
6	15580		21	14530		36	13480		51	12430	
.5	15545		.5	14495		.5	13445		.5	12395	
7	15510		22	14460		37	13410		52	12360	
.5	15475	7	.5	14425	7	.5	13375	7	.5	12325	7
8	15440		23	14390		38	13340		53	12290	
.5	15405		.5	14355		.5	13305		.5	12255	
9	15370		24	14320		39	13270		54	12220	
.5	15335		.5	14285		.5	13235		.5	12185	
10	15300		25	14250		40	13200		55	12150	
.5	15265		.5	14215		.5	13165		.5	12115	
11	15230		26	14180		41	13130		56	12080	
.5	15195		.5	14145		.5	13095		.5	12045	
12	15160		27	14110		42	13060		57	12010	
.5	15125		.5	14075		.5	13025		.5	11975	
13	15090		28	14040		43	12990		58	11940	
.5	15055		.5	14005		.5	12955		.5	11905	
14	15020		29	13970		44	12920		59	11870	
.5	14985		.5	13935		.5	12885		.5	11835	
15	14950		30	13900		45	12850		60	11800	

Allowable Unit Stresses in Pounds per Square Inch

by Compression Formula of

New York Building Law: $16000 - 70 \frac{l}{r}$

MAIN AND SECONDARY MEMBERS—Ratios of l/r up to 120

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
60	11800		75	10750		90	9700		105	8650	
.5	11765		.5	10715		.5	9665		.5	8615	
61	11730		76	10680		91	9630		106	8580	
.5	11695		.5	10645		.5	9595		.5	8545	
62	11660		77	10610		92	9560		107	8510	
.5	11625		.5	10575		.5	9525		.5	8475	
63	11590		78	10540		93	9490		108	8440	
.5	11555		.5	10505		.5	9455		.5	8405	
64	11520		79	10470		94	9420		109	8370	
.5	11485		.5	10435		.5	9385		.5	8335	
65	11450		80	10400		95	9350		110	8300	
.5	11415		.5	10365		.5	9315		.5	8265	
66	11380		81	10330		96	9280		111	8230	
.5	11345		.5	10295		.5	9245		.5	8195	
67	11310		82	10260		97	9210		112	8160	
.5	11275	7	.5	10225	7	.5	9175	7	.5	8125	7
68	11240		83	10190		98	9140		113	8090	
.5	11205		.5	10155		.5	9105		.5	8055	
69	11170		84	10120		99	9070		114	8020	
.5	11135		.5	10085		.5	9035		.5	7985	
70	11100		85	10050		100	9000		115	7950	
.5	11065		.5	10015		.5	8965		.5	7915	
71	11030		86	9980		101	8930		116	7880	
.5	10995		.5	9945		.5	8895		.5	7845	
72	10960		87	9910		102	8860		117	7810	
.5	10925		.5	9875		.5	8825		.5	7775	
73	10890		88	9840		103	8790		118	7740	
.5	10855		.5	9805		.5	8755		.5	7705	
74	10820		89	9770		104	8720		119	7670	
.5	10785		.5	9735		.5	8685		.5	7635	
75	10750		90	9700		105	8650		120	7600	

CARNEGIE BEAM SECTIONS

18-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 183 18″x12″			CB 182 18″x8½″			CB 181 18″x7½″			
	100 lbs.	93 lbs	86 lbs.	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.
1	462	430	397	357	330	307	264	237	232	214
2	454	422	390	348	321	298	256	230	225	207
3	445	414	383	338	312	290	248	222	217	200
4	437	406	375	328	303	282	239	214	209	193
5	428	398	368	319	294	273	231	207	202	186
6	420	390	361	309	285	265	222	199	194	180
7	412	383	354	299	276	256	214	191	186	173
8	403	375	346	290	267	248	205	184	179	166
9	395	367	339	280	258	240	197	176	171	159
10	386	359	332	270	249	231	189	168	163	152
11	378	351	324	261	240	223	180	161	155	145
12	369	343	317	251	231	214	172	153	148	138
13	361	335	310	241	222	206	163	145	140	131
14	353	328	302	231	213	198	155	138	132	124
15	344	320	295	222	204	189	146	130	125	117
16	336	312	288	212	195	181	138	122	117	110
17	327	304	281	202	186	172	130			
18	319	296	273	193	177	164				
19	311	288	266	183	168	156				
20	302	281	259							
21	294	273	251							
22	285	265	244							
23	277	257	237							
24	268	249	229							
25	260	241	222							
26	252	233	215							
27	243	226	208							
28	235	218	200							
29	226	210	193							
Area, in.²	29.40	27.35	25.29	22.94	21.17	19.69	17.05	15.30	15.00	13.82
I_{1-1}, in.⁴	1783.4	1648.4	1514.1	1318.8	1208.1	1117.1	960.8	855.1	810.0	768.6
r_{1-1}, in.	7.79	7.76	7.74	7.58	7.55	7.53	7.51	7.48	7.35	7.46
I_{2-2}, in.⁴	253.4	234.0	214.7	90.9	82.9	76.4	49.0	43.3	40.5	38.7
r_{2-2}, in.	2.94	2.93	2.91	1.99	1.98	1.97	1.70	1.68	1.64	1.67
Weight Lbs. per Foot	100	93	86	78	72	67	58	52	51	47

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

16-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 165 16″x14″			CB 164 16″x12″			CB 163 16″x8½″			CB 162 16″x7″				CB 161 16″x6″	
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs.	63 lbs.	58 lbs.	50 lbs.	45 lbs.	43 lbs.	40 lbs.	38 lbs.	35 lbs.
1	533	496	464	416	384	351	312	289	266	228	205	195	182	172	158
2	525	488	457	408	377	345	303	281	259	220	198	188	176	164	151
3	517	481	450	401	370	338	295	273	251	212	191	181	169	157	145
4	509	474	443	393	363	332	287	265	244	205	184	174	163	150	138
5	501	466	436	386	356	325	278	258	237	197	177	167	157	143	131
6	493	459	429	378	349	319	270	250	230	189	170	160	151	136	125
7	485	451	422	371	342	312	262	242	223	182	163	153	145	129	118
8	477	444	415	363	335	306	253	234	216	174	156	146	138	121	111
9	469	436	408	356	328	300	245	227	208	166	149	139	132	114	105
10	461	429	401	348	321	293	237	219	201	159	142	132	126	107	98
11	453	421	394	340	314	287	229	211	194	151	135	125	120	100	92
12	445	414	387	333	307	280	220	203	187	143	128	118	114	93	85
13	437	406	380	325	300	274	212	196	180	135	121	111	107	86	78
14	429	399	373	318	293	267	204	188	173	128	114	104	101		
15	421	391	366	310	286	261	195	180	165	120	107	97	95		
16	413	384	359	303	279	255	187	172	158	112	101				
17	405	376	352	295	272	248	179	165	151						
18	397	369	345	288	265	242	170	157	144						
19	389	362	338	280	258	235	162	149	137						
20	381	354	331	273	251	229	154	142	130						
21	373	347	324	265	244	222									
22	365	339	317	258	237	216									
23	357	332	310	250	230	210									
24	349	324	303	243	223	203									
25	341	317	296	235	216	197									
26	333	309	289	227	209	190									
28	317	294	275	212	195	177									
30	301	279	261												
32	285	264	247												
34	269	250	233												
Area, in.²	33.82	31.46	29.41	26.46	24.41	22.34	20.00	18.52	17.06	14.70	13.23	12.65	11.75	11.17	10.29
I_{1-1}, in.⁴	1665.6	1537.2	1426.8	1275.5	1167.7	1061.3	923.7	849.9	776.6	666.0	595.0	523.8	524.6	475.1	435.5
r_{1-1}, in.	7.02	6.99	6.97	6.94	6.92	6.89	6.80	6.77	6.75	6.73	6.71	6.44	6.68	6.52	6.50
I_{2-2}, in.⁴	426.2	393.9	366.0	230.0	210.4	191.1	81.3	74.6	68.0	38.2	34.0	28.9	29.8	19.2	17.5
r_{2-2}, in.	3.55	3.54	3.53	2.95	2.94	2.92	2.02	2.01	2.00	1.61	1.60	1.51	1.59	1.31	1.30
Weight Lbs. per Foot	115	107	100	90	83	76	68	63	58	50	45	43	40	38	35

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 146 14″x15″									
	305 lbs.	295 lbs.	285 lbs.	275 lbs.	265 lbs.	255 lbs.	245 lbs.	235 lbs.	225 lbs.	215 lbs.
1	1417	1371	1324	1277	1231	1184	1138	1091	1045	998
2	1399	1353	1307	1261	1215	1169	1123	1077	1031	985
3	1381	1335	1290	1244	1199	1154	1108	1063	1017	972
4	1362	1318	1273	1228	1183	1138	1093	1048	1004	959
5	1344	1300	1256	1211	1167	1123	1079	1034	990	946
6	1326	1282	1239	1195	1151	1107	1064	1020	976	933
7	1308	1265	1221	1178	1135	1092	1049	1005	962	919
8	1290	1247	1204	1161	1119	1076	1034	991	949	906
9	1271	1229	1187	1145	1103	1061	1019	977	935	893
10	1253	1212	1170	1128	1087	1045	1004	962	921	880
11	1235	1194	1153	1112	1071	1030	989	948	907	867
12	1217	1176	1136	1095	1055	1015	974	934	894	853
13	1199	1159	1119	1079	1039	999	959	919	880	840
14	1180	1141	1102	1062	1023	984	944	905	866	827
15	1162	1123	1085	1045	1007	968	930	891	852	814
16	1144	1106	1068	1029	991	953	915	876	839	801
17	1126	1088	1051	1012	975	937	900	862	825	787
18	1108	1071	1034	996	959	922	885	848	811	774
19	1089	1053	1016	979	943	906	870	833	797	761
20	1071	1035	999	963	927	891	855	819	784	748
22	1035	1000	965	929	895	860	825	790	756	721
24	998	965	931	896	863	829	796	762	729	695
26	962	929	897	863	831	798	766	733	701	669
28	926	894	863	830	799	768	736	704	673	642
30	889	859	828	797	767	737	706	676	646	616
32	853	823	794	764	735	706	676	647	618	589
34	816	788	760	731	703	675	647	618	591	563
36	780	753	726	697	671	644	617	590	563	537
38	744	718	692	664	639	613	587	561	536	510
40	707	682	658	631	607	582	557	532	508	484
Area, in.^{2}	89.70	86.76	83.82	80.87	77.93	74.99	72.06	69.11	66.17	63.23
$I_{1\text{-}1}$, in.^{4}	4121.5	3948.1	3778.1	3607.8	3442.4	3280.0	3119.6	2961.9	2806.2	2654.7
$r_{1\text{-}1}$, in.	6.78	6.75	6.71	6.68	6.65	6.61	6.58	6.55	6.51	6.48
$I_{2\text{-}2}$, in.^{4}	1539.1	1479.4	1420.7	1362.0	1304.2	1247.1	1190.6	1134.5	1079.1	1024.5
$r_{2\text{-}2}$, in.	4.14	4.13	4.12	4.10	4.09	4.08	4.06	4.05	4.04	4.03
Weight Lbs. per Foot	305	295	285	275	265	255	245	235	225	215

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot										
	CB 146 14″x15″										
	205 lbs.	195 lbs.	185 lbs.	175 lbs.	165 lbs.	155 lbs.	145 lbs.	135 lbs.	131 lbs.	125 lbs.	115 lbs.
1	952	905	859	813	766	720	673	627	608	580	534
2	939	893	848	802	756	710	664	618	599	572	527
3	927	881	836	791	745	700	655	610	591	564	519
4	914	869	825	780	735	690	646	601	582	556	512
5	901	857	813	769	725	681	637	593	573	548	505
6	889	845	802	758	715	671	628	584	565	541	497
7	876	833	790	747	704	661	618	576	556	523	490
8	863	821	779	736	694	652	609	567	548	525	483
9	851	809	767	726	684	642	600	559	539	517	475
10	838	797	756	715	673	632	591	550	530	509	468
11	826	785	744	704	663	622	582	542	522	501	461
12	813	773	733	693	653	613	573	533	513	493	453
13	800	761	721	682	643	603	564	524	505	485	446
14	788	749	710	671	632	593	555	516	496	477	439
15	775	737	699	660	622	584	546	507	488	469	432
16	762	725	687	649	612	574	536	499	479	461	424
17	750	713	676	638	601	564	527	490	470	453	417
18	737	701	664	627	591	554	518	482	462	446	410
19	725	689	653	617	581	545	509	473	453	438	402
20	712	677	641	606	570	535	500	465	445	430	395
22	687	653	618	584	550	515	482	448	428	414	380
24	661	628	595	562	529	496	464	431	410	398	366
26	636	604	572	540	509	477	445	414	393	382	351
28	611	580	549	519	488	457	427	397	376	366	337
30	586	556	526	497	468	438	409	380	359	351	322
32	560	532	504	475	447	418	391	363	342	335	307
34	535	508	481	453	426	399	372	346	325	319	293
36	510	481	458	431	406	379	354	329	307	303	278
38	485	460	435	410	385	360	336	312		287	264
40	459	436									
Area, in.^{2}	60.28	57.34	54.41	51.47	48.52	45.58	42.64	39.70	38.52	36.75	33.82
I_{1-1}, in.^{4}	2505.0	2358.2	2213.5	2071.7	1932.6	1796.8	1662.7	1530.4	1358.4	1402.1	1275.9
r_{1-1}, in.	6.45	6.41	6.38	6.34	6.31	6.28	6.24	6.21	5.94	6.18	6.14
I_{2-2}, in.^{4}	970.3	916.8	863.9	811.6	759.9	709.0	658.5	608.4	547.3	559.4	510.9
r_{2-2}, in.	4.01	4.00	3.98	3.97	3.96	3.94	3.93	3.92	3.77	3.90	3.89
Weight Lbs. per Foot	205	195	185	175	165	155	145	135	131	125	115

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 145 14″x12″			CB 144 14″x10″			CB 143 14″x8″			CB 142 14″x6¾″					CB 141 14″x6″
	105 lbs.	95 lbs.	85 lbs.	75 lbs.	68 lbs.	61 lbs.	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.
1	486	439	393	345	313	281	265	243	220	191	177	172	164	150	136
2	477	432	386	338	306	275	258	236	213	184	171	166	158	145	130
3	469	424	379	330	299	269	250	229	207	178	165	160	152	139	124
4	460	416	372	323	293	262	243	222	201	171	159	153	146	134	119
5	452	409	365	315	286	256	236	215	195	164	153	147	141	129	113
6	444	401	359	308	279	250	228	208	188	158	146	141	135	124	108
7	435	393	352	300	272	244	221	201	182	151	140	134	129	118	102
8	427	386	345	293	265	238	213	195	176	144	134	128	123	113	97
9	418	378	338	285	258	231	206	188	170	138	128	121	118	108	91
10	410	370	331	278	252	225	198	181	163	131	122	115	112	102	85
11	401	363	324	270	245	219	191	174	157	124	116	109	106	97	80
12	393	355	317	263	238	213	183	167	151	118	109	102	100	92	74
13	385	347	310	255	231	207	176	160	145	111	103	96	95	87	69
14	376	340	303	248	224	201	168	153	139	105	97	89	89	81	
15	368	332	297	240	217	194	161	147	132	98	91		83	76	
16	359	324	290	233	211	188	153	140	126						
17	351	317	283	225	204	182	146	133	120						
18	342	309	276	218	197	176	139	126	114						
19	334	301	269	210	190	170	131	119	107						
20	326	294	262	203	183	164									
21	317	286	255	195	176	157									
22	309	278	248	188	170	151									
23	300	271	242	180	163	145									
24	292	263	235	173	156	139									
25	284	255	228												
26	275	248	221												
27	267	240	214												
28	258	232	207												
29	250	225	200												
30	241	217	193												
Area, in.²	30.88	27.93	24.99	22.05	19.99	17.94	17.05	15.59	14.12	12.35	11.47	11.18	10.58	9.71	8.82
I_{1-1}, in.⁴	1169.6	1044.0	921.3	823.5	738.8	656.2	609.4	552.5	496.0	431.5	398.3	357.5	365.6	333.4	292.0
r_{1-1}, in.	6.15	6.11	6.07	6.11	6.08	6.05	5.98	5.95	5.93	5.91	5.89	5.66	5.88	5.86	5.75
I_{2-2}, in.⁴	292.6	262.0	232.0	134.5	120.6	107.1	62.8	56.8	50.8	30.2	27.7	24.2	25.4	23.0	15.5
r_{2-2}, in.	3.08	3.06	3.05	2.47	2.46	2.44	1.92	1.91	1.90	1.56	1.56	1.47	1.55	1.54	1.33
Weight Lbs. per Foot	105	95	85	75	68	61	58	53	48	42	39	38	36	33	30

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 127 12"x14"					CB 126 12"x14"				CB 125 12"x12"			
	230 lbs.	220 lbs.	210 lbs.	200 lbs.	190 lbs.	180 lbs.	170 lbs.	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.
1	1067	1021	974	928	881	835	788	742	696	647	601	555	509
2	1052	1006	960	914	869	823	777	731	686	636	591	545	500
3	1037	991	946	901	856	810	765	721	676	624	580	535	491
4	1021	977	932	888	843	798	754	710	666	613	569	526	482
5	1006	962	918	875	831	786	742	699	656	601	559	516	474
6	991	948	904	861	818	774	731	688	646	590	548	506	465
7	976	933	891	848	806	762	719	678	636	578	538	497	456
8	961	919	877	835	793	749	708	667	626	567	527	487	447
9	946	904	863	821	780	737	696	656	616	555	516	477	438
10	930	889	849	808	768	725	685	645	605	544	506	468	430
11	915	875	835	795	755	713	673	634	595	532	495	458	421
12	900	860	821	781	742	700	662	624	585	521	485	448	412
13	885	846	807	768	730	688	650	613	575	509	474	439	403
14	870	831	793	755	717	676	639	602	565	498	463	429	395
15	854	817	779	741	704	664	627	591	555	486	453	419	386
16	839	802	765	728	692	652	616	581	545	475	442	410	377
17	824	788	751	715	679	639	604	570	535	464	432	400	368
18	809	773	737	701	666	627	593	559	525	452	421	390	359
19	794	758	723	688	654	615	581	548	515	441	410	380	351
20	778	744	709	675	641	603	570	538	505	429	400	371	342
22	748	715	681	648	616	578	547	516	486	406	379	351	324
24	718	686	653	621	590	554	524	494	465	383	357	332	307
26	687	656	626	595	565	529	501	473	445	360	336	313	289
28	657	627	598	568	540	505	478	451	425	337	315	293	272
30	626	598	570	542	515	481	455	430	405	314	294	274	254
32	596	569	542	515	489	456	432	408	385				
34	566	540	514	488	464	432	409	387	364				
36	535	511	486	462	439	407	386	365	344				
Area, in.^{2}	67.64	64.70	61.76	58.82	55.88	52.94	50.00	47.06	44.12	41.18	38.24	35.28	32.34
I_{1-1}, in.^{4}	1461.9	1426.6	1391.3	1356.1	1320.8	1218.1	1182.8	1147.5	1112.2	934.8	899.5	864.1	828.8
r_{1-1}, in.	4.65	4.70	4.75	4.80	4.86	4.80	4.86	4.94	5.02	4.76	4.85	4.95	5.06
I_{2-2}, in.^{4}	945.5	898.2	852.9	809.5	767.8	702.4	666.9	633.0	600.4	372.4	350.5	329.6	309.9
r_{2-2}, in.	3.74	3.73	3.72	3.71	3.71	3.64	3.65	3.67	3.69	3.01	3.03	3.06	3.10
Weight Lbs. per Foot	230	220	210	200	190	180	170	160	150	140	130	120	110

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot											
	CB 124 12″x10″				CB 123 12″x8″			CB 122 12″x6½″				CB 121 12″x6″
	100 lbs.	91 lbs.	83 lbs.	75 lbs.	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.
1	460	419	382	345	229	206	183	164	154	145	127	113
2	450	410	374	338	223	200	178	158	148	140	122	108
3	440	400	365	331	216	195	173	152	142	135	118	104
4	429	391	357	323	210	189	168	146	137	130	113	99
5	419	382	349	316	204	183	163	141	131	125	109	95
6	409	372	340	309	198	178	158	135	125	120	104	90
7	398	363	331	301	191	172	153	129	119	115	100	86
8	388	354	324	294	185	167	148	124	114	109	95	81
9	378	344	315	286	179	161	143	118	108	104	91	77
10	367	335	307	279	173	155	138	112	102	99	86	72
11	357	326	298	272	166	150	133	106	96	94	82	68
12	347	316	290	264	160	144	128	101	90	89	77	63
13	336	307	282	257	154	138	122	95	85	84	73	59
14	326	298	273	249	148	133	117	89	79	79	68	
15	316	288	265	242	142	127	112	83		73	64	
16	305	279	257	235	135	121	107					
17	295	270	248	227	129	116	102					
18	285	260	240	220	123	110	97					
19	274	251	232	213	117	104	92					
20	264	242	223	205								
21	253	232	215	198								
22	243	223	206	190								
23	233	214	198	183								
24		204	190	176								
25				168								
Area, in.²	29.41	26.76	24.41	22.05	14.69	13.23	11.76	10.59	9.99	9.40	8.22	7.34
I_{1-1}, in.⁴	659.0	627.2	598.9	570.7	400.5	356.9	313.7	280.1	238.1	246.3	213.4	183.0
r_{1-1}, in.	4.73	4.84	4.95	5.09	5.22	5.19	5.17	5.14	4.88	5.12	5.10	4.99
I_{2-2}, in.⁴	167.5	155.9	147.0	138.5	57.5	51.2	44.9	25.4	21.0	22.3	19.2	13.8
r_{2-2}, in.	2.39	2.41	2.45	2.51	1.98	1.97	1.95	1.55	1.45	1.54	1.53	1.37
Weight Lbs. per Foot	100	91	83	75	50	45	40	36	34	32	28	25

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

10-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 105 10″x12″						CB 104 10″x10″				CB 103 10″x9″		
	140 lbs.	132 lbs.	124 lbs.	116 lbs.	108 lbs.	100 lbs.	92 lbs.	84 lbs.	77 lbs.	70 lbs.	63 lbs.	56 lbs.	49 lbs.
1	647	610	574	537	500	463	424	387	355	323	289	257	225
2	636	600	564	527	491	455	415	378	347	316	282	251	220
3	625	589	554	518	483	447	406	370	340	309	275	245	215
4	614	579	544	509	474	439	397	362	332	302	267	238	209
5	603	568	534	500	466	431	387	353	325	296	260	232	204
6	591	558	524	491	457	424	378	345	317	289	253	226	199
7	580	547	514	481	449	416	369	337	309	282	246	220	193
8	569	537	504	472	440	408	360	328	302	275	239	213	188
9	558	526	494	463	432	400	351	320	294	268	231	207	183
10	546	516	484	454	423	392	342	312	287	262	224	201	177
11	535	505	474	445	415	385	333	303	279	255	216	194	172
12	524	494	465	435	406	377	324	295	271	248	209	188	167
13	513	484	455	426	397	369	315	286	264	241	202	182	161
14	502	473	445	417	389	361	306	278	256	234	195	175	156
15	490	463	435	408	380	353	297	270	249	228	187	169	151
16	479	452	425	399	372	345	287	261	241	221	180	163	145
17	468	442	415	389	363	338	278	253	234	214	173	157	140
18	457	431	405	380	355	330	269	245	226	207	166	150	135
19	445	421	395	371	346	322	260	236	218	201	158	144	129
20	434	410	385	362	338	314	251	228	211	194	151	138	124
21	423	399	375	352	329	306	242	220	203	187	144	131	119
22	412	389	365	343	321	299	233	211	196	180		125	113
23	400	378	355	334	312	291	224	203	188	173			
24	389	368	346	325	304	283	215	194	180	167			
25	378	357	336	316	295	275	206		173	160			
26	367	347	326	306	287	267							
27	356	336	316	297	278	259							
28	344	326	306	288	270	252							
29	333	315	296	279	261	244							
30	322	304	286	269	253	236							
Area, in.^{2}	41.17	38.81	36.46	34.11	31.76	29.40	27.06	24.70	22.65	20.59	18.53	16.47	14.41
I_{1-1}, in.^{4}	623.2	603.5	583.9	564.3	544.8	525.1	423.2	403.6	386.5	369.3	300.4	283.2	266.0
r_{1-1}, in.	3.89	3.94	4.00	4.07	4.14	4.23	3.96	4.04	4.13	4.24	4.03	4.15	4.30
I_{2-2}, in.^{4}	391.4	369.6	349.0	329.4	310.7	292.8	163.1	152.0	142.9	134.3	85.2	79.5	74.2
r_{2-2}, in.	3.08	3.09	3.09	3.11	3.13	3.16	2.50	2.48	2.51	2.55	2.14	2.20	2.27
Weight Lbs. per Foot	140	132	124	116	108	100	92	84	77	70	63	56	49

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Continued

10 and 9-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 102 10″x8″			CB 101 10″x6″				CB 93 9″x9″			CB 92 9″x6½″		
	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs.	48 lbs.	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.
1	192	164	142	136	118	104	95	221	198	175	159	145	132
2	186	159	138	131	113	100	91	215	193	170	154	141	127
3	180	154	134	126	109	96	88	210	188	166	149	136	123
4	174	150	130	121	104	92	84	205	184	162	143	131	118
5	168	145	126	116	100	88	80	200	179	158	138	126	114
6	162	140	121	110	95	84	76	195	174	154	132	121	109
7	156	135	117	105	91	80	73	190	170	150	127	116	105
8	150	130	113	100	86	76	69	184	165	146	122	111	100
9	144	125	109	95	82	72	65	179	160	141	116	106	96
10	138	120	105	90	77	68	61	174	156	137	111	101	91
11	132	115	101	85	73	64	58	169	151	133	106	96	87
12	126	110	97	80	68	61	54	164	146	129	100	91	82
13	120	105	93	75	64	57	50	158	142	125	95	86	78
14	114	100	89	70	59	53		153	137	121	89	81	73
15	108	95	85					148	132	116	84	76	69
16	102	90	81					143	128	112	79	71	
17	96	85	77					138	123	108			
18		80	73					133	118	104			
19								127	114	100			
20								122	109	96			
21								117	104	92			
22								112	100	87			
Area, in.²	12.35	10.58	9.11	8.82	7.64	6.76	6.17	14.11	12.65	11.17	10.29	9.40	8.53
I_{1-1}, in.⁴	190.4	175.6	163.4	163.2	139.5	122.2	107.6	221.1	195.5	170.4	155.4	140.5	126.0
r_{1-1}, in.	3.93	4.07	4.23	4.30	4.27	4.25	4.18	3.96	3.93	3.91	3.89	3.87	3.84
I_{2-2}, in.⁴	36.8	34.4	32.5	18.5	15.7	13.7	12.0	73.8	65.4	57.1	26.6	24.0	21.5
r_{2-2}, in.	1.73	1.80	1.89	1.45	1.43	1.43	1.39	2.29	2.28	2.26	1.61	1.60	1.59
Weight Lbs. per Foot	42	36	31	30	26	23	21	48	43	38	35	32	29

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

CARNEGIE BEAM SECTIONS—Concluded

8-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot													
	CB 83 8″x8″											CB82 8″x6½″		
	90 lbs.	84 lbs.	78 lbs	72 lbs.	66 lbs.	60 lbs.	54 lbs.	48 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.
1	413	386	358	330	303	275	247	220	192	165	142	136	123	109
2	403	376	349	322	295	268	241	214	187	160	138	132	119	106
3	393	366	340	314	287	261	235	208	182	156	134	127	115	102
4	383	357	331	305	280	254	228	203	177	152	130	123	110	98
5	372	347	322	297	272	247	222	197	172	147	127	118	106	95
6	362	337	313	288	264	240	215	191	167	143	123	114	102	91
7	352	328	304	280	256	232	209	185	162	138	119	109	98	87
8	342	318	295	272	249	225	202	180	157	134	115	105	94	83
9	331	308	286	263	241	218	196	174	152	130	111	100	90	80
10	321	299	277	255	233	211	190	168	147	125	108	96	86	76
11	311	289	268	246	225	204	183	162	142	121	104	91	82	72
12	301	280	259	238	218	197	177	157	136	116	100	86	78	69
13	290	270	250	230	210	190	170	151	131	112	96	82	73	65
14	280	260	241	221	202	183	164	145	126	108	92	77	69	61
15	270	251	232	213	195	176	157	139	121	103	89	73	65	58
16	260	241	223	205	187	169	151	134	116	99	85	68	61	54
17	249	231	214	196	179	162	144	128	111	94	81			
18	239	222	205	188	171	155	138	122	106	90	77			
19	229	212	196	179	164	147	132	116	101	86	73			
20	219	202	187	171	156	140	125	111	96	81	70			
21	208	193	178	163	148									
Area, in.²	26.47	24.71	22.93	21.17	19.40	17.63	15.87	14.10	12.34	10.58	9.10	8.81	7.93	7.06
I_{1-1}, in.⁴	391.2	358.6	326.5	295.9	265.9	237.1	209.2	182.2	156.2	131.3	110.9	107.8	95.9	84.3
r_{1-1}, in.	3.84	3.81	3.77	3.74	3.70	3.67	3.63	3.59	3.56	3.52	3.49	3.50	3.48	3.46
I_{2-2}, in.⁴	124.4	114.5	104.7	95.3	86.1	77.1	68.3	59.7	51.4	43.4	36.7	23.4	20.8	18.3
r_{2-2}, in.	2.17	2.15	2.14	2.12	2.11	2.09	2.07	2.06	2.04	2.02	2.01	1.63	1.62	1.61
Weight Lbs. per Foot	90	84	78	72	66	60	54	48	42	36	31	30	27	24

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

STANDARD MILL SECTIONS

Miscellaneous Small Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of New York Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	B 40 9″x5¼″		B 39 8″x5″		H 4 8″x8″			H 3 A 6″x6″		H 3 6″x6″		H 2 5″x5″	H 1 4″x4″
	25 lbs.	21 lbs.	21 lbs.	18 lbs.	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.
1	112	94	94	80	171	156	148	124	113	102	90	84	60
2	106	90	89	76	166	151	144	120	109	98	87	80	57
3	100	85	84	72	161	147	139	115	104	94	83	76	53
4	95	81	79	68	156	142	135	110	100	89	80	72	50
5	89	76	74	64	151	138	131	105	96	85	76	68	46
6	84	71	69	60	146	133	127	100	91	81	73	65	43
7	78	67	63	56	141	129	123	96	87	77	69	61	39
8	72	62	58	51	136	124	118	91	83	73	65	57	36
9	67	58	53	47	131	120	114	86	79	69	62	53	32
10	61	53	48	43	126	115	110	81	74	65	58	49	
11		49			120	111	106	76	70	61	55	45	
12					115	106	102	72	66	57	51	42	
13					110	102	97	67	61	53	48		
14					105	97	93	62	57				
15					100	93	89						
16					95	88	85						
17					90	84	81						
18					85	79	76						
19							72						
Area, in.²	7.34	6.17	6.17	5.29	11.00	10.00	9.50	8.08	7.33	6.61	5.86	5.47	3.99
I_{1-1}, in.⁴	95.5	87.6	63.4	58.7	120.8	115.5	112.8	49.3	47.0	41.0	38.8	23.8	10.7
r_{1-1}, in.	3.61	3.77	3.21	3.33	3.31	3.40	3.45	2.47	2.53	2.49	2.57	2.08	1.64
I_{2-2}, in.⁴	8.8	8.1	6.6	6.1	36.9	35.1	34.2	16.0	14.9	12.2	11.4	7.8	3.6
r_{2-2}, in.	1.09	1.14	1.03	1.07	1.83	1.87	1.90	1.41	1.43	1.36	1.39	1.20	0.95
Weight Lbs. per Foot	25	21	21	18	37.7	34.3	32.6	27.5	25	22.5	20	18.9	13.8

Safe load values above are for ratios of l/r not over 120, for both main and secondary members.

Allowable Unit Stresses in Pounds per Square Inch

by Compression Formula of

Chicago Building Law: $16000-70\ \frac{l}{r}$

The following tables give the unit stresses for ratios of l/r in intervals of 5/10. Intermediate values may be found by interpolation from the figures given for the tenth units of l/r by adding or deducting from the nearest tabulated figure the corresponding multiple.

Example: Unit stress for l/r=38.2 and l/r=112.8

l/r= 38.2 13305 +21 or 13340—14=13326

l/r=112.8 8090 +14 or 8125—21= 8105

MAIN MEMBERS—Ratios of l/r up to 120

SECONDARY MEMBERS—Ratios of l/r up to 150

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
			37.5	13375		50	12500		62.5	11625	
			38	13340		.5	12465		63	11590	
			.5	13305		51	12430		.5	11555	
			39	13270		.5	12395		64	11520	
	Maximum		.5	13235		52	12360		.5	11485	
			40	13200		.5	12325		65	11450	
28.57	14000		.5	13165		53	12290		.5	11415	
			41	13130		.5	12255		66	11380	
29	13970		.5	13095		54	12220		.5	11345	
.5	13935		42	13060		.5	12185		67	11310	
30	13900		.5	13025		55	12150		.5	11275	
.5	13865		43	12990		.5	12115		68	11240	
31	13830	7	.5	12955	7	56	12080	7	.5	11205	7
.5	13795		44	12920		.5	12045		69	11170	
32	13760		.5	12885		57	12010		.5	11135	
.5	13725		45	12850		.5	11975		70	11100	
33	13690		.5	12815		58	11940		.5	11065	
.5	13655		46	12780		.5	11905		71	11030	
34	13620		.5	12745		59	11870		.5	10995	
.5	13585		47	12710		.5	11835		72	10960	
35	13550		.5	12675		60	11800		.5	10925	
.5	13515		48	12640		.5	11765		73	10890	
36	13480		.5	12605		61	11730		.5	10855	
.5	13445		49	12570		.5	11695		74	10820	
37	13410		.5	12535		62	11660		.5	10785	
.5	13375		50	12500		.5	11625		75	10750	

Allowable Unit Stresses in Pounds per Square Inch by Compression Formula of Chicago Building Law: $16000-70\frac{l}{r}$

MAIN MEMBERS—Ratios of l/r up to 120

SECONDARY MEMBERS—Ratios of l/r up to 150

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio. l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
75	10750		95	9350		115	7950		135	6550	
.5	10715		.5	9315		.5	7915		.5	6515	
76	10680		96	9280		116	7880		136	6480	
.5	10645		.5	9245		.5	7845		.5	6445	
77	10610		97	9210		117	7810		137	6410	
.5	10575		.5	9175		.5	7775		.5	6375	
78	10540		98	9140		118	7740		138	6340	
.5	10505		.5	9105		.5	7705		.5	6305	
79	10470		99	9070		119	7670		139	6270	
.5	10435		.5	9035		.5	7635		.5	6235	
80	10400		100	9000		120	7600		140	6200	
.5	10365		.5	8965		.5	7565		.5	6165	
81	10330		101	8930		121	7530		141	6130	
.5	10295		.5	8895		.5	7495		.5	6095	
82	10260		102	8860		122	7460		142	6060	
.5	10225		.5	8825		.5	7425		.5	6025	
83	10190		103	8790		123	7390		143	5990	
.5	10155		.5	8755		.5	7355		.5	5955	
84	10120		104	8720		124	7320		144	5920	
.5	10085		.5	8685		.5	7285		.5	5885	
85	10050	7	105	8650	7	125	7250	7	145	5850	7
.5	10015		.5	8615		.5	7215		.5	5815	
86	9980		106	8580		126	7180		146	5780	
.5	9945		.5	8545		.5	7145		.5	5745	
87	9910		107	8510		127	7110		147	5710	
.5	9875		.5	8475		.5	7075		.5	5675	
88	9840		108	8440		128	7040		148	5640	
.5	9805		.5	8405		.5	7005		.5	5605	
89	9770		109	8370		129	6970		149	5570	
.5	9735		.5	8335		.5	6935		.5	5535	
90	9700		110	8300		130	6900		150	5500	
.5	9665		.5	8265		.5	6865				
91	9630		111	8230		131	6830				
.5	9595		.5	8195		.5	6795				
92	9560		112	8160		132	6760				
.5	9525		.5	8125		.5	6725				
93	9490		113	8090		133	6690				
.5	9455		.5	8055		.5	6655				
94	9420		114	8020		134	6620				
.5	9385		.5	7985		.5	6585				
95	9350		115	7950		135	6550				

CARNEGIE BEAM SECTIONS

18-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 183 18″x12″			CB 182 18″x8½″			CB 181 18″x7½″			
	100 lbs.	93 lbs.	86 lbs.	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.
3	412	383	354	321	296	276	239	214	210	194
4	412	383	354	321	296	276	239	214	209	193
5	412	383	354	319	294	273	231	207	202	186
6	412	383	354	309	285	265	222	199	194	180
7	412	383	354	299	276	256	214	191	186	173
8	403	375	346	290	267	248	205	184	179	166
9	395	367	339	280	258	240	197	176	171	159
10	386	359	332	270	249	231	189	168	163	152
11	378	351	324	261	240	223	180	161	155	145
12	369	343	317	251	231	214	172	153	148	138
13	361	335	310	241	222	206	163	145	140	131
14	353	328	302	231	213	198	155	138	132	124
15	344	320	295	222	204	189	146	130	125	117
16	336	312	288	212	195	181	138	122	117	110
17	327	304	281	202	186	172	130	115	109	103
18	319	296	273	193	177	164	121	107	102	96
19	311	288	266	183	168	156	113	99	94	89
20	302	281	259	173	159	147	104	92	86	82
21	294	273	251	164	150	139	96	84		
22	285	265	244	154	141	130				
23	277	257	237	144	132	122				
24	268	249	229	135	123	114				
25	260	241	222							
26	252	233	215							
27	243	226	208							
28	235	218	200							
29	226	210	193							
30	218	202	186							
32	201	186	171							
34	184	171	156							
36	167	155	142							
Area, in.²	29.40	27.35	25.29	22.94	21.17	19.69	17.05	15.30	15.00	13.82
I_{1-1}, in.⁴	1783.4	1648.4	1514.1	1318.8	1208.1	1117.1	960.8	855.1	810.0	768.6
r_{1-1}, in.	7.79	7.76	7.74	7.58	7.55	7.53	7.51	7.48	7.35	7.46
I_{2-2}, in.⁴	253.4	234.0	214.7	90.9	82.9	76.4	49.0	43.3	40.5	38.7
r_{2-2}, in.	2.94	2.93	2.91	1.99	1.98	1.97	1.70	1.68	1.64	1.67
Weight Lbs. per Foot	100	93	86	78	72	67	58	52	51	47

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

16-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 165 16″x14″			CB 164 16″x12″			CB 163 16″x8½″			CB 162 16″x7″				CB 161 16″x6″	
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs.	63 lbs.	58 lbs.	50 lbs.	45 lbs.	43 lbs.	40 lbs.	38 lbs.	35 lbs.
3	473	440	412	370	342	313	280	259	239	206	185	177	165	156	144
4	473	440	412	370	342	313	280	259	239	205	184	174	163	150	138
5	473	440	412	370	342	313	278	258	237	197	177	167	157	143	131
6	473	440	412	370	342	313	270	250	230	189	170	160	151	136	125
7	473	440	412	370	342	312	262	242	223	182	163	153	145	129	118
8	473	440	412	363	335	306	253	234	216	174	156	146	138	121	111
9	469	436	408	356	328	300	245	227	208	166	149	139	132	114	105
10	461	429	401	348	321	293	237	219	201	159	142	132	126	107	98
11	453	421	394	340	314	287	229	211	194	151	135	125	120	100	92
12	445	414	387	333	307	280	220	203	187	143	128	118	114	93	85
13	437	406	380	325	300	274	212	196	180	135	121	111	107	86	78
14	429	399	373	318	293	267	204	188	173	128	114	104	101	78	72
15	421	391	366	310	286	261	195	180	165	120	107	97	95	71	65
16	413	384	359	303	279	255	187	172	158	112	101	90	89	64	58
17	405	376	352	295	272	248	179	165	151	105	94	83	82		
18	397	369	345	288	265	242	170	157	144	97	87	76	76		
19	389	362	338	280	258	235	162	149	137	89	80		70		
20	381	354	331	273	251	229	154	142	130	82	73				
22	365	339	317	258	237	216	137	126	115						
24	349	324	303	243	223	203	120	111	101						
26	333	309	289	227	209	190									
28	317	294	275	212	195	177									
30	301	279	261	197	181	165									
32	285	264	247	182	167	152									
34	269	250	233	167	153	139									
36	253	235	219	152	139	126									
38	237	220	205												
40	221	205	191												
42	205	190	177												
44	189	175	163												
Area, in.²	33.82	31.46	29.41	26.46	24.41	22.34	20.00	18.52	17.06	14.70	13.23	12.65	11.75	11.17	10.29
I_{1-1}, in.⁴	1665.6	1537.2	1426.8	1275.5	1167.7	1061.3	923.7	849.9	776.6	666.0	595.0	523.8	524.6	475.1	435.5
r_{1-1}, in.	7.02	6.99	6.97	6.94	6.92	6.89	6.80	6.77	6.75	6.73	6.71	6.44	6.68	6.52	6.50
I_{2-2}, in.⁴	426.2	393.9	366.0	230.0	210.4	191.1	81.3	74.6	68.0	38.2	34.0	28.9	29.8	19.2	17.5
r_{2-2}, in.	3.55	3.54	3.53	2.95	2.94	2.92	2.02	2.01	2.00	1.61	1.60	1.51	1.59	1.31	1.30
Weight Lbs. per Foot	115	107	100	90	83	76	68	63	58	50	45	43	40	38	35

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 146 14″x15″									
	305 lbs.	295 lbs.	285 lbs.	275 lbs.	265 lbs.	255 lbs.	245 lbs.	235 lbs.	225 lbs.	215 lbs.
6	1256	1215	1173	1132	1091	1050	1009	968	926	885
7	1256	1215	1173	1132	1091	1050	1009	968	926	885
8	1256	1215	1173	1132	1091	1050	1009	968	926	885
9	1256	1215	1173	1132	1091	1050	1009	968	926	885
10	1253	1212	1170	1128	1087	1045	1004	962	921	880
11	1235	1194	1153	1112	1071	1030	989	948	907	867
12	1217	1176	1136	1095	1055	1015	974	934	894	853
13	1199	1159	1119	1079	1039	999	959	919	880	840
14	1180	1141	1102	1062	1023	984	944	905	866	827
15	1162	1123	1085	1045	1007	968	930	891	852	814
16	1144	1106	1068	1029	991	953	915	876	839	801
17	1126	1088	1051	1012	975	937	900	862	825	787
18	1108	1071	1034	996	959	922	885	848	811	774
19	1089	1053	1016	979	943	906	870	833	797	761
20	1071	1035	999	963	927	891	855	819	784	748
22	1035	1000	965	929	895	860	825	790	756	721
24	998	965	931	896	863	829	796	762	729	695
26	962	929	897	863	831	798	766	733	701	669
28	926	894	863	830	799	768	736	704	673	642
30	889	859	828	797	767	737	706	676	646	616
32	853	823	794	764	735	706	676	647	618	589
34	816	788	760	731	703	675	647	618	591	563
36	780	753	726	697	671	644	617	590	563	537
38	744	718	692	664	639	613	587	561	536	510
40	707	682	658	631	607	582	557	532	508	484
42	671	647	623	598	575	551	528	504	481	457
44	634	612	589	565	543	521	498	475	453	431
46	598	576	555	532	511	490	468	446	426	405
48	562	541	521	499	479	459	438	418	398	378
50	525	506	487	465	447	428	408	389	371	352
Area, in.^{2}	89.70	86.76	83.82	80.87	77.93	74.99	72.06	69.11	66.17	63.23
I_{1-1}, in.^{4}	4121.5	3948.1	3778.1	3607.8	3442.4	3280.0	3119.6	2961.9	2806.2	2654.7
r_{1-1}, in.	6.78	6.75	6.71	6.68	6.65	6.61	6.58	6.55	6.51	6.48
I_{2-2}, in.^{4}	1539.1	1479.4	1420.7	1362.0	1304.2	1247.1	1190.6	1134.5	1079.1	1024.5
r_{2-2}, in.	4.14	4.13	4.12	4.10	4.09	4.08	4.06	4.05	4.04	4.03
Weight Lbs. per Foot	305	295	285	275	265	255	245	235	225	215

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot										
	CB 146 14″x15″										
	205 lbs.	195 lbs.	185 lbs.	175 lbs.	165 lbs.	155 lbs.	145 lbs.	135 lbs.	131 lbs.	125 lbs.	115 lbs.
6	844	803	762	721	679	638	597	556	539	515	473
7	844	803	762	721	679	638	597	556	539	515	473
8	844	803	762	721	679	638	597	556	539	515	473
9	844	803	762	721	679	638	597	556	539	515	473
10	838	797	756	715	673	632	591	550	530	509	468
11	826	785	744	704	663	622	582	542	522	501	461
12	813	773	733	693	653	613	573	533	513	493	453
13	800	761	721	682	643	603	564	524	505	485	446
14	788	749	710	671	632	593	555	516	496	477	439
15	775	737	699	660	622	584	546	507	488	469	432
16	762	725	687	649	612	574	536	499	479	461	424
17	750	713	676	638	601	564	527	490	470	453	417
18	737	701	664	627	591	554	518	482	462	446	410
19	725	689	653	617	581	545	509	473	453	438	402
20	712	677	641	606	570	535	500	465	445	430	395
22	687	653	618	584	550	515	482	448	428	414	380
24	661	628	595	562	529	496	464	431	410	398	366
26	636	604	572	540	509	477	445	414	393	382	351
28	611	580	549	519	488	457	427	397	376	366	337
30	586	556	526	497	468	438	409	380	359	351	322
32	560	532	504	475	447	418	391	363	342	335	307
34	535	508	481	453	426	399	372	346	325	319	293
36	510	481	458	431	406	379	354	329	307	303	278
38	485	460	435	410	385	360	336	312	290	287	264
40	459	436	412	388	365	341	318	294	270	271	249
42	434	412	389	366	344	321	299	277	256	256	234
44	409	388	366	344	323	302	281	260	239	240	220
46	384	364	343	323	303	282	263	243	222	224	205
48	358	339	320	301	282	263	245	226		208	191
50	333	315									
Area, in.^{2}	60.28	57.34	54.41	51.47	48.52	45.58	42.64	39.70	38.52	36.75	33.82
I_{1-1}, in.^{4}	2505.0	2358.2	2213.5	2071.7	1932.6	1796.8	1662.7	1530.4	1358.4	1402.1	1275.9
r_{1-1}, in.	6.45	6.41	6.38	6.34	6.31	6.28	6.24	6.21	5.94	6.18	6.14
I_{2-2}, in.^{4}	970.3	916.8	863.9	811.6	759.9	709.0	658.5	608.4	547.3	559.4	510.9
r_{2-2}, in.	4.01	4.00	3.98	3.97	3.96	3.94	3.93	3.92	3.77	3.90	3.89
Weight Lbs. per Foot	205	195	185	175	165	155	145	135	131	125	115

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

14-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot															
	CB 145 14″x12″			CB 144 14″x10″			CB 143 14″x8″			CB 142 14″x6¾″						CB 141 14″x6″
	105 lbs.	95 lbs.	85 lbs.	75 lbs.	68 lbs.	61 lbs.	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.	
3	432	391	350	309	280	251	239	218	198	173	161	157	148	136	123	
4	432	391	350	309	280	251	239	218	198	171	159	153	146	134	119	
5	432	391	350	309	280	251	236	215	195	164	153	147	141	129	113	
6	432	391	350	308	279	250	228	208	188	158	146	141	135	124	108	
7	432	391	350	300	272	244	221	201	182	151	140	134	129	118	102	
8	427	386	345	293	265	238	213	195	176	144	134	128	123	113	97	
9	418	378	338	285	258	231	206	188	170	138	128	121	118	108	91	
10	410	370	331	278	252	225	198	181	163	131	122	115	112	102	85	
11	401	363	324	270	245	219	191	174	157	124	116	109	106	97	80	
12	393	355	317	263	238	213	183	167	151	118	109	102	100	92	74	
13	385	347	310	255	231	207	176	160	145	111	103	96	95	87	69	
14	376	340	303	248	224	201	168	153	139	105	97	89	89	81	63	
15	368	332	297	240	217	194	161	147	132	98	91	83	83	76	58	
16	359	324	290	233	211	188	153	140	126	91	85	77	78	71	52	
17	351	317	283	225	204	182	146	133	120	85	79	70	72	65		
18	342	309	276	218	197	176	139	126	114	78	72	64	66	60		
19	334	301	269	210	190	170	131	119	107	71	66		60	55		
20	326	294	262	203	183	164	124	112	101							
22	309	278	248	188	170	151	109	99	89							
24	292	263	235	173	156	139	94									
26	275	248	221	158	142	126										
28	258	232	207	143	129	114										
30	241	217	193	128	115	102										
32	225	202	180													
34	208	186	166													
36	191	171	152													
38	174	156	138													
Area, in.²	30.88	27.93	24.99	22.05	19.99	17.94	17.05	15.59	14.12	12.35	11.47	11.18	10.58	9.71	8.82	
I_{1-1}, in.⁴	1169.6	1044.0	921.3	823.5	738.8	656.2	609.4	552.5	496.0	431.5	398.3	357.5	365.6	333.4	292.0	
r_{1-1}, in.	6.15	6.11	6.07	6.11	6.08	6.05	5.98	5.95	5.93	5.91	5.89	5.66	5.88	5.86	5.75	
I_{2-2}, in.⁴	292.6	262.0	232.0	134.5	120.6	107.1	62.8	56.8	50.8	30.2	27.7	24.2	25.4	23.0	15.5	
r_{2-2}, in.	3.08	3.06	3.05	2.47	2.46	2.44	1.92	1.91	1.90	1.56	1.56	1.47	1.55	1.54	1.33	
Weight Lbs. per Foot	105	95	85	75	68	61	58	53	48	42	39	38	36	33	30	

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 127 12″x14″					CB 126 12″x14″				CB 125 12″x12″			
	230 lbs.	220 lbs.	210 lbs.	200 lbs.	190 lbs.	180 lbs.	170 lbs.	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.
6	947	906	865	823	782	741	700	659	618	577	535	494	453
7	947	906	865	823	782	741	700	659	618	577	535	494	453
8	947	906	865	823	782	741	700	659	618	567	527	487	447
9	946	904	863	821	780	737	696	656	616	555	516	477	438
10	930	889	849	808	768	725	685	645	605	544	506	468	430
11	915	875	835	795	755	713	673	634	595	532	495	458	421
12	900	860	821	781	742	700	662	624	585	521	485	448	412
13	885	846	807	768	730	688	650	613	575	509	474	439	403
14	870	831	793	755	717	676	639	602	565	498	463	429	395
15	854	817	779	741	704	664	627	591	555	486	453	419	386
16	839	802	765	728	692	652	616	581	545	475	442	410	377
17	824	788	751	715	679	639	604	570	535	464	432	400	368
18	809	773	737	701	666	627	593	559	525	452	421	390	359
19	794	758	723	688	654	615	581	548	515	441	410	380	351
20	778	744	709	675	641	603	570	538	505	429	400	371	342
22	748	715	681	648	616	578	547	516	486	406	379	351	324
24	718	686	653	621	590	554	524	494	465	383	357	332	307
26	687	656	626	595	565	529	501	473	445	360	336	313	289
28	657	627	598	568	540	505	478	451	425	337	315	293	272
30	626	598	570	542	515	481	455	430	405	314	294	274	254
32	596	569	542	515	489	456	432	408	385	291	273	255	237
34	566	540	514	488	464	432	409	387	364	268	251	235	219
36	535	511	486	462	439	407	386	365	344	245	230	216	201
38	505	482	458	435	413	383	363	344	324			196	184
40	475	452	430	408	388	358	340	322	304				
42	444	423	402	382	363	334	317	301	284				
44	414	394	375	355	337	309	294	279	264				
46	383	365	347	329	312				244				
Area, in.^{2}	67.64	64.70	61.76	58.82	55.88	52.94	50.00	47.06	44.12	41.18	38.24	35.28	32.34
I_{1-1}, in.^{4}	1461.9	1426.6	1391.3	1356.1	1320.8	1218.1	1182.8	1147.5	1112.2	934.8	899.5	864.1	828.8
r_{1-1}, in.	4.65	4.70	4.75	4.80	4.86	4.80	4.86	4.94	5.02	4.76	4.85	4.95	5.06
I_{2-2}, in.^{4}	945.5	898.2	852.9	809.5	767.8	702.4	666.9	633.0	600.4	372.4	350.5	329.6	309.9
r_{2-2}, in.	3.74	3.73	3.72	3.71	3.71	3.64	3.65	3.67	3.69	3.01	3.03	3.06	3.10
Weight Lbs. per Foot	230	220	210	200	190	180	170	160	150	140	130	120	110

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

12-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot											
	CB 124 12″x10″				CB 123 12″x8″			CB 122 12″x6½″				CB 121 12″x6″
	100 lbs.	91 lbs.	83 lbs.	75 lbs.	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.
3	412	375	342	309	206	185	165	148	140	132	115	103
4	412	375	342	309	206	185	165	146	137	130	113	99
5	412	375	342	309	204	183	163	141	131	125	109	95
6	409	372	340	309	198	178	158	135	125	120	104	90
7	398	363	331	301	191	172	153	129	119	115	100	86
8	388	354	324	294	185	167	148	124	114	109	95	81
9	378	344	315	286	179	161	143	118	108	104	91	77
10	367	335	307	279	173	155	138	112	102	99	86	72
11	357	326	298	272	166	150	133	106	96	94	82	68
12	347	316	290	264	160	144	128	101	90	89	77	63
13	336	307	282	257	154	138	122	95	85	84	73	59
14	326	298	273	249	148	133	117	89	79	79	68	54
15	316	288	265	242	142	127	112	83	73	73	64	50
16	305	279	257	235	135	121	107	78	67	68	59	45
17	295	270	248	227	129	116	102	72	61	63	55	41
18	285	260	240	220	123	110	97	66	56	58	50	
19	274	251	232	213	117	104	92	60		53	46	
20	264	242	223	205	110	99	87					
21	253	232	215	198	104	93	82					
22	243	223	206	190	98	88	77					
23	233	214	198	183	92	82	72					
24	222	204	190	176	85	76	67					
25	212	195	181	168								
26	202	186	173	161								
27	191	176	165	154								
28	181	167	156	146								
29	171	158	148	139								
30		148	139	131								
31			131	124								
Area, in.²	29.41	26.76	24.41	22.05	14.69	13.23	11.76	10.59	9.99	9.40	8.22	7.34
I_{1-1}, in.⁴	659.0	627.2	598.9	570.7	400.5	356.9	313.7	280.1	238.1	246.3	213.4	183.0
r_{1-1}, in.	4.73	4.84	4.95	5.09	5.22	5.19	5.17	5.14	4.88	5.12	5.10	4.99
I_{2-2}, in.⁴	167.5	155.9	147.0	138.5	57.5	51.2	44.9	25.4	21.0	22.3	19.2	13.8
r_{2-2}, in.	2.39	2.41	2.45	2.51	1.98	1.97	1.95	1.55	1.45	1.54	1.53	1.37
Weight Lbs. per Foot	100	91	83	75	50	45	40	36	34	32	28	25

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

10-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 105 10″x12″						CB 104 10″x10″				CB 103 10″x9″		
	140 lbs.	132 lbs.	124 lbs.	116 lbs.	108 lbs.	100 lbs.	92 lbs.	84 lbs.	77 lbs.	70 lbs.	63 lbs.	56 lbs.	49 lbs
5	576	543	511	478	445	418	379	346	317	288	259	231	202
6	576	543	511	478	445	418	378	345	317	288	253	226	199
7	576	543	511	478	445	418	369	337	309	282	246	220	193
8	569	537	504	472	440	408	360	328	302	275	239	213	188
9	558	526	494	463	432	400	351	320	294	268	231	207	183
10	546	516	484	454	423	392	342	312	287	262	224	201	177
11	535	505	474	445	415	385	333	303	279	255	216	194	172
12	524	494	465	435	406	377	324	295	271	248	209	188	167
13	513	484	455	426	397	369	315	286	264	241	202	182	161
14	502	473	445	417	389	361	306	278	256	234	195	175	156
15	490	463	435	408	380	353	297	270	249	228	187	169	151
16	479	452	425	399	372	345	287	261	241	221	180	163	145
17	468	442	415	389	363	338	278	253	234	214	173	157	140
18	457	431	405	380	355	330	269	245	226	207	166	150	135
19	445	421	395	371	346	322	260	236	218	201	158	144	129
20	434	410	385	362	338	314	251	228	211	194	151	138	124
21	423	399	375	352	329	306	242	220	203	187	144	131	119
22	412	389	365	343	321	299	233	211	196	180	136	125	113
23	400	378	355	334	312	291	224	203	188	173	129	119	108
24	389	368	346	325	304	283	215	194	180	167	122	113	103
25	378	357	336	316	295	275	206	186	173	160	115	106	97
26	367	347	326	306	287	267	197	178	165	153	107	100	92
27	356	336	316	297	278	259	187	169	158	146		94	87
28	344	326	306	288	270	252	178	161	150	140			81
29	333	315	296	279	261	244	169	153	143	133			
30	322	304	286	269	253	236	160	144	135	126			
32	299	283	266	251	235	220							
34	277	262	246	233	218	205							
36	255	241	227	214	201	189							
38	232	220	207	196	184	173							
Area, in.^{2}	41.17	38.81	36.46	34.11	31.76	29.40	27.06	24.70	22.65	20.59	18.53	16.47	14.41
I_{1-1}, in.^{4}	623.2	603.5	583.9	564.3	544.8	525.1	423.2	403.6	386.5	369.3	300.4	283.2	266.0
r_{1-1}, in.	3.89	3.94	4.00	4.07	4.14	4.23	3.96	4.04	4.13	4.24	4.03	4.15	4.30
I_{2-2}, in.^{4}	391.4	369.6	349.0	329.4	310.7	292.8	163.1	152.0	142.9	134.3	85.2	79.5	74.2
r_{2-2}, in.	3.08	3.09	3.09	3.11	3.13	3.16	2.50	2.48	2.51	2.55	2.14	2.20	2.27
Weight Lbs. per Foot	140	132	124	116	108	100	92	84	77	70	63	56	49

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Continued

10 and 9-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 102 10″x8″			CB 101 10″x6″				CB 93 9″x9″			CB 92 9″x6½″		
	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs.	48 lbs.	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.
1	173	148	128	123	107	95	86	198	177	156	144	132	119
2	173	148	128	123	107	95	86	198	177	156	144	132	119
3	173	148	128	123	107	95	86	198	177	156	144	132	119
4	173	148	128	121	104	92	84	198	177	156	143	131	118
5	168	145	126	116	100	88	80	198	177	156	138	126	114
6	162	140	121	110	95	84	76	195	174	154	132	121	109
7	156	135	117	105	91	80	73	190	170	150	127	116	105
8	150	130	113	100	86	76	69	184	165	146	122	111	100
9	144	125	109	95	82	72	65	179	160	141	116	106	96
10	138	120	105	90	77	68	61	174	156	137	111	101	91
11	132	115	101	85	73	64	58	169	151	133	106	96	87
12	126	110	97	80	68	61	54	164	146	129	100	91	82
13	120	105	93	75	64	57	50	158	142	125	95	86	78
14	114	100	89	70	59	53	47	153	137	121	89	81	73
15	108	95	85	64	55	49	43	148	132	116	84	76	69
16	102	90	81	59	50	45	39	143	128	112	79	71	64
17	96	85	77	54	46	41	35	138	123	108	73	67	60
18	90	80	73	49				133	118	104	68	62	55
19	84	75	69					127	114	100	63	57	51
20	78	71	65					122	109	96	57	52	
21	72	66	61					117	104	92			
22		61	57					112	100	87			
23			53					107	95	83			
24								102	90	79			
25								96	86	75			
26								91	81	71			
27								86	76	67			
28								81	72	62			
Area, in.²	12.35	10.58	9.11	8.82	7.64	6.76	6.17	14.11	12.65	11.17	10.29	9.40	8.53
I_{1-1}, in.⁴	190.4	175.6	163.4	163.2	139.5	122.2	107.6	221.1	195.5	170.4	155.4	140.5	126.0
r_{1-1}, in.	3.93	4.07	4.23	4.30	4.27	4.25	4.18	3.96	3.93	3.91	3.89	3.87	3.84
I_{2-2}, in.⁴	36.8	34.4	32.5	18.5	15.7	13.7	12.0	73.8	65.4	57.1	26.6	24.0	21.5
r_{2-2}, in.	1.73	1.80	1.89	1.45	1.43	1.43	1.39	2.29	2.28	2.26	1.61	1.60	1.59
Weight Lbs. per Foot	42	36	31	30	26	23	21	48	43	38	35	32	29

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

CARNEGIE BEAM SECTIONS—Concluded

8-Inch Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot													
	CB 83 8″x8″											CB 82 8″x6½″		
	90 lbs.	84 lbs.	78 lbs.	72 lbs.	66 lbs.	60 lbs.	54 lbs.	48 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.
1	371	346	321	296	272	247	222	197	173	148	127	123	111	99
2	371	346	321	296	272	247	222	197	173	148	127	123	111	99
3	371	346	321	296	272	247	222	197	173	148	127	123	111	99
4	371	346	321	296	272	247	222	197	173	148	127	123	110	98
5	371	346	321	296	272	247	222	197	172	147	127	118	106	95
6	362	337	313	288	264	240	215	191	167	143	123	114	102	91
7	352	328	304	280	256	232	209	185	162	138	119	109	98	87
8	342	318	295	272	249	225	202	180	157	134	115	105	94	83
9	331	308	286	263	241	218	196	174	152	130	111	100	90	80
10	321	299	277	255	233	211	190	168	147	125	108	96	86	76
11	311	289	268	246	225	204	183	162	142	121	104	91	82	72
12	301	280	259	238	218	197	177	157	136	116	100	86	78	69
13	290	270	250	230	210	190	170	151	131	112	96	82	73	65
14	280	260	241	221	202	183	164	145	126	108	92	77	69	61
15	270	251	232	213	195	176	157	139	121	103	89	73	65	58
16	260	241	223	205	187	169	151	134	116	99	85	68	61	54
17	249	231	214	196	179	162	144	128	111	94	81	64	57	50
18	239	222	205	188	171	155	138	122	106	90	77	59	53	47
19	229	212	196	179	164	147	132	116	101	86	73	55	49	43
20	219	202	187	171	156	140	125	111	96	81	70	50	45	39
21	208	193	178	163	148	133	119	105	91	77	66			
22	198	183	169	154	141	126	112	99	86	72	62			
23	188	173	160	146	133	119	106	93	81	68	58			
24	178	164	151	137	125	112	99	88	75	64	54			
25	167	154	142	129	117	105	93	82	70	59	51			
26	157	144	133	121	110	98								
27	147													
Area, in.²	26.47	24.71	22.93	21.17	19.40	17.63	15.87	14.10	12.34	10.58	9.10	8.81	7.93	7.06
I_{1-1}, in.⁴	391.2	358.6	326.5	295.9	265.9	237.1	209.2	182.2	156.2	131.3	110.9	107.8	95.9	84.3
r_{1-1}, in.	3.84	3.81	3.77	3.74	3.70	3.67	3.63	3.59	3.56	3.52	3.49	3.50	3.48	3.46
I_{2-2}, in.⁴	124.4	114.5	104.7	95.3	86.1	77.1	68.3	59.7	51.4	43.4	36.7	23.4	20.8	18.3
r_{2-2}, in.	2.17	2.15	2.14	2.12	2.11	2.09	2.07	2.06	2.04	2.02	2.01	1.63	1.62	1.61
Weight Lbs. per Foot	90	84	78	72	66	60	54	48	42	36	31	30	27	24

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

STANDARD MILL SECTIONS

Miscellaneous Small Columns

Allowable Concentric Loads in Thousands of Pounds

Unit Stress—City of Chicago Code

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	B 40 9″x5¼″		B 39 8″x5″		H 4 8″x8″			H 3-A 6″x6″		H 3 6″x6″		H 2 5″x5″	H 1 4″x4″
	25 lbs.	21 lbs.	21 lbs.	18 lbs.	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.
1	103	86	86	74	154	140	133	113	103	93	82	77	56
2	103	86	86	74	154	140	133	113	103	93	82	77	56
3	100	85	84	72	154	140	133	113	103	93	82	76	53
4	95	81	79	68	154	140	133	110	100	89	80	72	50
5	89	76	74	64	151	138	131	105	96	85	76	68	46
6	84	71	69	60	146	133	127	100	91	81	73	65	43
7	78	67	63	56	141	129	123	96	87	77	69	61	39
8	72	62	58	51	136	124	118	91	83	73	65	57	36
9	67	58	53	47	131	120	114	86	79	69	62	53	32
10	61	53	48	43	126	115	110	81	74	65	58	49	29
11	55	49	43	39	120	111	106	76	70	61	55	45	25
12	50	44	38	35	115	106	102	72	66	57	51	42	
13	44	40		31	110	102	97	67	61	53	48	38	
14		35			105	97	93	62	57	49	44	34	
15					100	93	89	57	53	45	41	30	
16					95	88	85	52	48	40	37		
17					90	84	81	47	44	36	34		
18					85	79	76						
19					80	75	72						
20					75	70	68						
21					70	66	64						
22					65	61	60						
23						57	55						
Area, in.²	7.34	6.17	6.17	5.29	11.00	10.00	9.50	8.08	7.33	6.61	5.86	5.47	3.99
I_{1-1}, in.⁴	95.5	87.6	63.4	58.7	120.8	115.5	112.8	49.3	47.0	41.0	38.8	23.8	10.7
r_{1-1}, in.	3.61	3.77	3.21	3.33	3.31	3.40	3.45	2.47	2.53	2.49	2.57	2.08	1.64
I_{2-2}, in.⁴	8.8	8.1	6.6	6.1	36.9	35.1	34.2	16.0	14.9	12.2	11.4	7.8	3.6
r_{2-2}, in.	1.09	1.14	1.03	1.07	1.83	1.87	1.90	1.41	1.43	1.36	1.39	1.20	0.95
Weight Lbs. per Foot	25	21	21	18	37.7	34.3	32.6	27.5	25	22.5	20	18.9	13.8

Safe loads above upper zig-zag line represent values not exceeding 14,000 pounds per square inch.
Values above lower zig-zag line represent ratios of l/r not exceeding 120.
Values below lower zig-zag line represent ratios of l/r not exceeding 150.

OFFICES

GENERAL OFFICES:

Pittsburgh, Carnegie Building, 434 Fifth Avenue.

DISTRICT OFFICES:

Birmingham, Brown-Marx Building, 2000 First Avenue, North,
Boston, Statler Office Building, 20 Providence Street,
Buffalo, The Marine Trust Co. Building, 233-239 Main Street,
Chicago, 208 South La Salle Street,
Cincinnati, Union Trust Building, Fourth and Walnut Streets,
Cleveland, Rockefeller Building, 614 Superior Avenue, N. W.,
Denver, First National Bank Building, 17th and Stout Streets,
Detroit, 2130 Buhl Building, 535 Griswold Street,
New Orleans, Maison Blanche, 921 Canal Street,
New York, Empire Building, 71 Broadway,
Philadelphia, Widener Building, Chestnut and Juniper Streets,
Pittsburgh, Carnegie Building, 434 Fifth Avenue,
St. Louis, 506 Olive Street,
St. Paul, 1308 Merchants National Bank Building, 4th & Robert Sts.

EXPORT REPRESENTATIVES:

UNITED STATES STEEL PRODUCTS CO.,
New York, Hudson Terminal, 30 Church Street.

PACIFIC COAST REPRESENTATIVES:

UNITED STATES STEEL PRODUCTS CO., PACIFIC COAST DEPT.
Los Angeles, 2087 East Slauson Avenue,
Portland, 777 Nicolai Street,
San Francisco, Russ Building, Pine and Montgomery Streets,
Seattle, Fourth Avenue South and Connecticut Street.